



### FROM THE EDITOR

**DR. ANNALISA C CHRISTIE**, University of the Highlands and Islands

I would like to thank all those who have put forward papers for this issue. We have had a lot of contributions in the last 6 months and these document the rich variety of archaeo-malacological research taking place around the world. From biometric assessments of ancient and modern Limpets in my own backyard in Orkney to shell mound occupation in Guyana. With your continued support the next issue will be as diverse and exciting. If you would like to contribute, please contact [annalisa.christie@gmail.co.uk](mailto:annalisa.christie@gmail.co.uk).

All opinions expressed in the newsletter are those of the authors and not necessarily those of the editor or online hosts. Current and previous issues of the newsletter are available at <http://archaeomalacology.com> and <http://home.earthlink.net/~aydinslibrary/AMGnews.htm>.

### IN THIS ISSUE

- Shell Biometrics in Limpets Samples from Orkney
- Recording Breakage in True Limpet Shells
- Some additional shells from Horvat Shallale
- Recent Radiocarbon Dates for Occupations of Siriki and Wyva Creek Shell Mounds, Northwestern Guyana
- Exploitation of marine Shells during the Late Iron Age: Gathering territory, dietary choices and circulation networks - "The example of Cormelles-le-Royal (Plain of Caen, Lower-Normandy, France)"
- Freshwater molluscs from an excavated well at Yotvata, Arava Valley, Israel
- The Shells From The Epipaleolithic Site Of Givat Hayil 35, Western Negev, Israel
- Shells from an excavation near Bir el Tamad, Sinai, Egypt
- Recent Publications
- PhD Abstract
- Forthcoming Conferences

### SHELL BIOMETRICS IN ARCHAEOLOGICAL AND PRESENT DAY LIMPET SAMPLES FROM AROUND ORKNEY.

**T. L. BRANSOMBE, M.C. BELL, I. MAINLAND, A. WANT<sup>1</sup>**

#### ACKNOWLEDGEMENTS

I would like to thank Dr. Angela Drummond for encouraging all her pupils to apply for this scheme, the Nuffield Foundation as well as ICIT of Heriot-Watt University for giving me the wonderful opportunity to take part in this project. Also, I would like to thank my supervisors Andrew Want, Mike Bell and Ingrid Mainland and also the Nuffield Coordinator, Frances Chapman, for their much appreciated help and guidance and support throughout the project.

#### INTRODUCTION

The coastal locations of virtually all of the archaeological sites on Orkney mean that shell is commonly found throughout them, especially in midden and floor contexts. In many of Orkney's archaeological sites the sandy soil gives a high pH (the soil is alkaline) which also lends to good preservation of these shells so that many of them are complete and measurable samples. Limpet shells are commonly accepted to change in shape according to environmental factors (both at different sites and shore levels) such as wave action, in order to reduce the drag

<sup>1</sup> [tansybranscombe@yahoo.co.uk](mailto:tansybranscombe@yahoo.co.uk), [m.c.bell@hw.ac.uk](mailto:m.c.bell@hw.ac.uk), [Ingrid.mainland@uhi.ac.uk](mailto:Ingrid.mainland@uhi.ac.uk), [a.want@hw.ac.uk](mailto:a.want@hw.ac.uk)

the waves produce in travelling over them. Due to these variations, limpet shells can be useful when looking at archaeological sites as they can be used in relating the archaeological samples to modern sites and therefore showing which beaches (and in some cases even the shore level on the beach) they were being collected from by the people inhabiting the sites at the time. They can also be used to find possible patterns of size selection by ancient gatherers as well as detecting differences between samples from different archaeological eras.

In this investigation, primary evidence was collected to attempt to look further into these possibilities and gauge whether these techniques would be applicable to the archaeological limpet samples on Orkney. In the following report, the findings will be presented under two broad topics; the relation of archaeological samples to present day populations and evidence of size selection by gatherers. The archaeological eras involved in this project are the late Iron Age, represented by samples from contexts at The Cairns and Mine Howe, and the Viking Age represented by contexts at Snusgar. For the research and implications of only modern collections taken at the same time, see Fairnie 2012.

## HYPOTHESIS

It was expected that the modern limpet samples would show significant change in shell shape and size according to their locations on the shore and to the exposure at that location. It was thought that the drag created by higher exposure would result in lower, narrower shells in order for the limpets to become more streamlined and this was expected to be more prominent the lower down the shore where the limpets would be submerged (and exposed to wave action) for longer than those further up the shore. However, it was also considered that due to the increased time spent submerged by the lower shore limpets they would have more feeding opportunity and so their meat content could be larger making them attractive to gatherers. The variability according to exposure was expected to help place the archaeological limpet samples geographically by measuring which of the sites their morphometrics were closer to, perhaps even down as far as shore level. It seemed logical that ancient gatherers would have selected their limpets by size, avoiding the smaller limpets in order to have enough large limpets for use as food or bait. For this reason it was predicted that the size distribution of the archaeological samples would have a much smaller range than that of the archaeological limpets, because in the collection of the modern samples all limpets were taken regardless of their size.

## METHOD

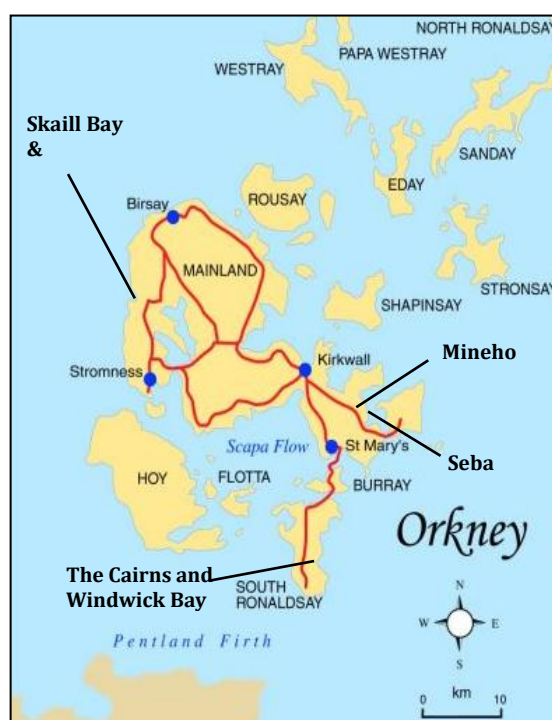


FIGURE 1: MAP SHOWING SAMPLING AND ARCHAEOLOGICAL SITES

The first part of the project consisted of the collection and measurement of the limpet samples. Six sites were chosen from which to collect limpet samples; three archaeological sites and three modern sites. The modern sites were chosen to be as close as possible to the archaeological sites as these were deemed the most likely places that the archaeological samples could have been collected from. The destinations eventually chosen were Skail, Windwick and Seba to correspond with the archaeological samples from the Viking site at Snusgar, the late Iron Age site at The Cairns and the Iron Age site at Mine Howe, respectively (FIGURE 1).

At the modern sites, three 4m<sup>2</sup> quadrats were marked out: one each in the upper, mid and lower shore areas. All the limpets were then removed from these areas using knives, and were put into separate bags. As many limpets as possible were measured on site to minimise fatality rates, but some did have to be taken back to the laboratory to be boiled and measured there. For each quadrat the degree of slope, geographical co-ordinates and the percent seaweed cover (estimated by eye) were also taken (TABLE 1).

SITE	SHORE LEVEL	DATE	GPS	SLOPE	SEAWEED COVERAGE
Skaill	Upper	03/07/2012	N59.05660 W3.33747	8°	F. Spiralis (all) 20%
	Mid	03/07/2012	N59.05660 W3.33760	9°	F. Vesiculosus (all) 50%
	Lower	03/07/2012	N59.056636 W3.33813	8°	25% (50% F. Serratus 50% F. Vesiculosus)
Sebay	Upper	05/07/2012	N58.94026 W2.82960	13°	F. Spiralis (all) 45%
	Mid	05/07/2012	N58.94015 W2.82953	13°	80% (60% Ascophyllum 40% F. Spiralis)
	Lower	05/07/2012	N58.94032 W2.82932	13°	100% (all) Ascophyllum
Windwick	Upper	19/07/2012	N58.76578 W2.93668	N/A	40% (30% Ascophyllum 35% F. Serratus 35% F. Vesiculosus)
	Mid	19/07/2012	N58.76577 W2.93643	N/A	30% (10% Ascophyllum 50% F. Serratus 40% F. Vesiculosus)
	Lower	19/07/2012	N58.76583 W2.93613	N/A	20% (60% F. Serratus 40% F. Vesiculosus)

TABLE 1: SITE DESCRIPTORS

The measurements taken from each limpet consisted of maximum height, length and width, aa (apex to anterior), ap (apex to posterior) and x (the length from the apex to anterior along a horizontal axis rather than following the slope of the shell). Along with this, for each limpet a subjective 'starriness' rating was also taken on a scale of 1-5, with 1 being completely smooth and 5 being extremely starry.

The archaeological samples were taken from the Orkney Research Centre for Archaeology, based at Orkney College, under the guidance of the bone specialist Ingrid Mainland. For each archaeological context the samples were sieved using a 4mm gauze. The greater than 4mm fragments were used to count minimum number of individuals (MNI) and the number of identifiable specimens (NISP) which were both then weighed (TABLE 2).

SITE	CONTEXT	MEASURABLE LIMPETS	MNI	WEIGHT (G)	NISP	WEIGHT (G)
Minehowe	56, 35	0	0	0	14	6.11
Minehowe	46, 33	0	1	1.39	11	1.85
Minehowe	500, 75	6	7	9.79	10	10.05
Minehowe	58	3	5	5.5	7	10.01
Minehowe	503, 83	9	13	16.82	128	44.87
Minehowe	503, 81	93	139	371.27	143	380.54
Snusgar	2232	46	51	217.37	88	253.72
Snusgar	2263	50	57	172.87	88	205.29
Snusgar	2264	30	39	113.78	43	115.82
Snusgar	2261	52	64	108.45	81	201.27
Snusgar	3362	32	38	140.84	48	150.5
The Cairns	703*	238	427	1053.59	2157	1515.8

\*Only some of context sampled and measured

TABLE 2: ARCHAEOLOGICAL CONTEXT RECORDS

These were then separated further into measurable and unmeasurable limpets which were also weighed, along with the fragments of less than 4mm and the greater than 4mm fragments from the samples that were not limpet (stone and other shell). For Mine Howe the entire limpet population was measured as there were relatively few, however in Snusgar nine different contexts from a range of areas and dates were chosen and only these were recorded. For the Cairns, only a sample of one context was recorded due to its large size. An extra measurement – level of erosion – also had to be added for the archaeological limpets as a measure of taphonomic processes that had affected the shell while buried. This was on a scale of 1-3 (FIGURES 2-4) with one being the best preserved and 3 being the least well preserved.



**FIGURE 2: PHOTOGRAPH AND DESCRIPTOR OF PRISTINE/NEAR PRISTINE LIMPETS**

The shell will either be smooth or clearly defined, unworn ridges. No stepping (lamellar degradation) on surface. Inside should be clearly marked and shiny with remnants of colour.



**FIGURE 3: PHOTOGRAPH AND DESCRIPTOR OF LIMPETS SHOWING SURFACE EROSION**

Obviously degraded (though still visible) ridges, but still no stepping or lamellar degradation. Markings inside the shell will probably not be clear, and the shell will have a bleached look all over.



**FIGURE 4: PHOTOGRAPH AND DESCRIPTOR OF LIMPETS SHOWING HEAVY EROSION**

Lamellar degradation present on surface shown through stepping. Uneven surface, obviously eroded. Interior again with no clear marking and entire shell bleached.

After all the limpets were measured, the resulting measurements were tabulated in Microsoft Excel. Power law graphs were made showing height by length, width by length, x by length and height by width. These helped to point out obviously incorrect data that had been mistyped or wrongly taken (often the limpets could be re-measured as those in the lab were all numbered). Following this, a series of further graphs and tables were formulated in order to analyse the measurements including size distribution histograms.

### **RELATING ARCHAEOLOGICAL SAMPLES TO NEARBY PRESENT DAY POPULATIONS**

To investigate this topic the power law graphs for Skail, Windwick and Sebay (**FIGURE 5**) were compared to roughly gauge whether each modern site had a distinctly different growth rate. While a strong positive correlation could be seen in each graph, on the surface they looked broadly similar. To attempt to detect subtler differences in these, each graph was then assigned an equation in the form of  $y=ax^b$ , where 'b' expresses the proportionality between the two shown dimensions and 'a' expresses the allometry of growth. It was decided that differences in the 'a' and 'b' values for each site could show differences between how each limpet population grew, so these values were plotted against each other, with a graph for each relationship (e.g. height/length) showing the 'a'/'b' values for each site (**FIGURE 6**).

These graphs showed a negative correlation, with 'b' decreasing as 'a' increases. The modern points on the graph were grouped according to site to see whether they could be separated in order for archaeological points to be placed into a specific site. However, when grouped there were large areas of overlap which meant that the archaeological values could not be assigned to a specific modern site with any certainty. When placed on the graph alongside the modern values, the 'a'/'b' values for the archaeological samples were often quite apart from the main group. The values for The Cairns, in particular, seemed far off in all but the graph for the x/l relationship, whereas the values for Mine Howe usually stayed within the group of modern values. These large differences also added to the difficulty in associating the archaeological samples to nearby present day ones as even if the modern day values had grouped distinctly, most of the archaeological samples would have fallen far out of these groups.

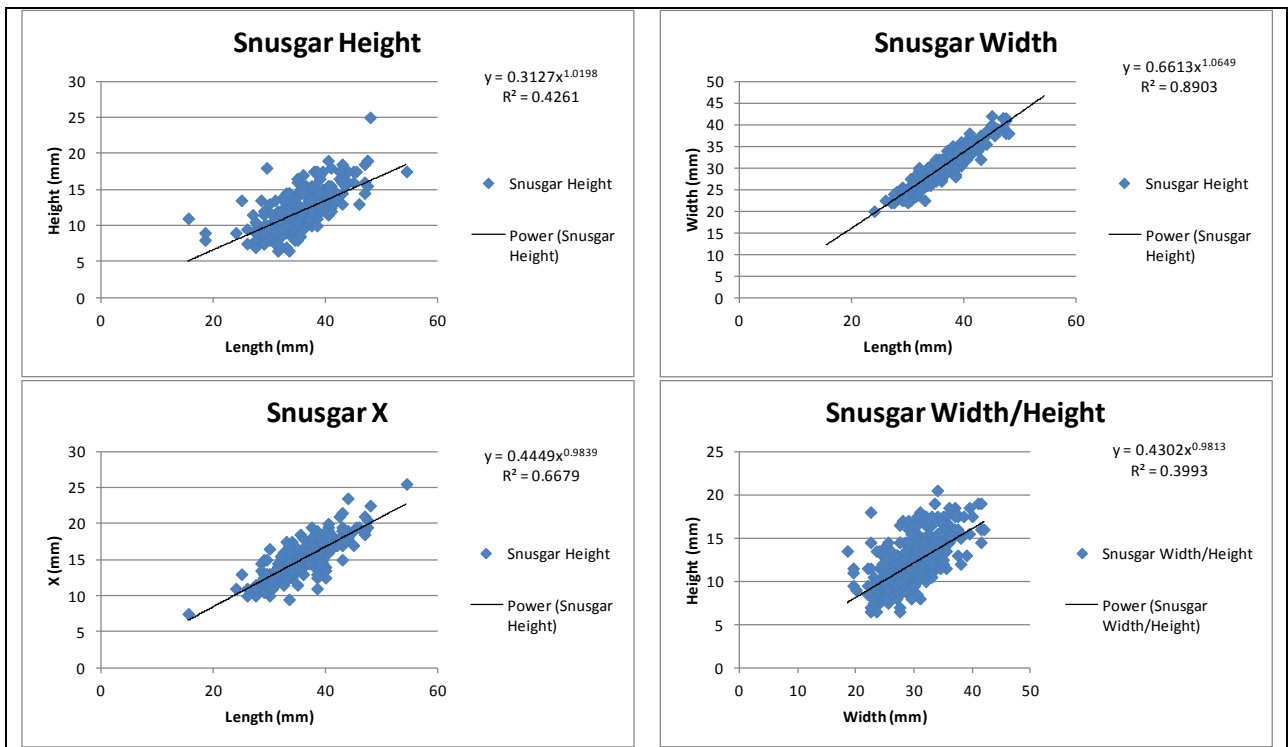


FIGURE 5: EXAMPLE POWER LAW GRAPHS

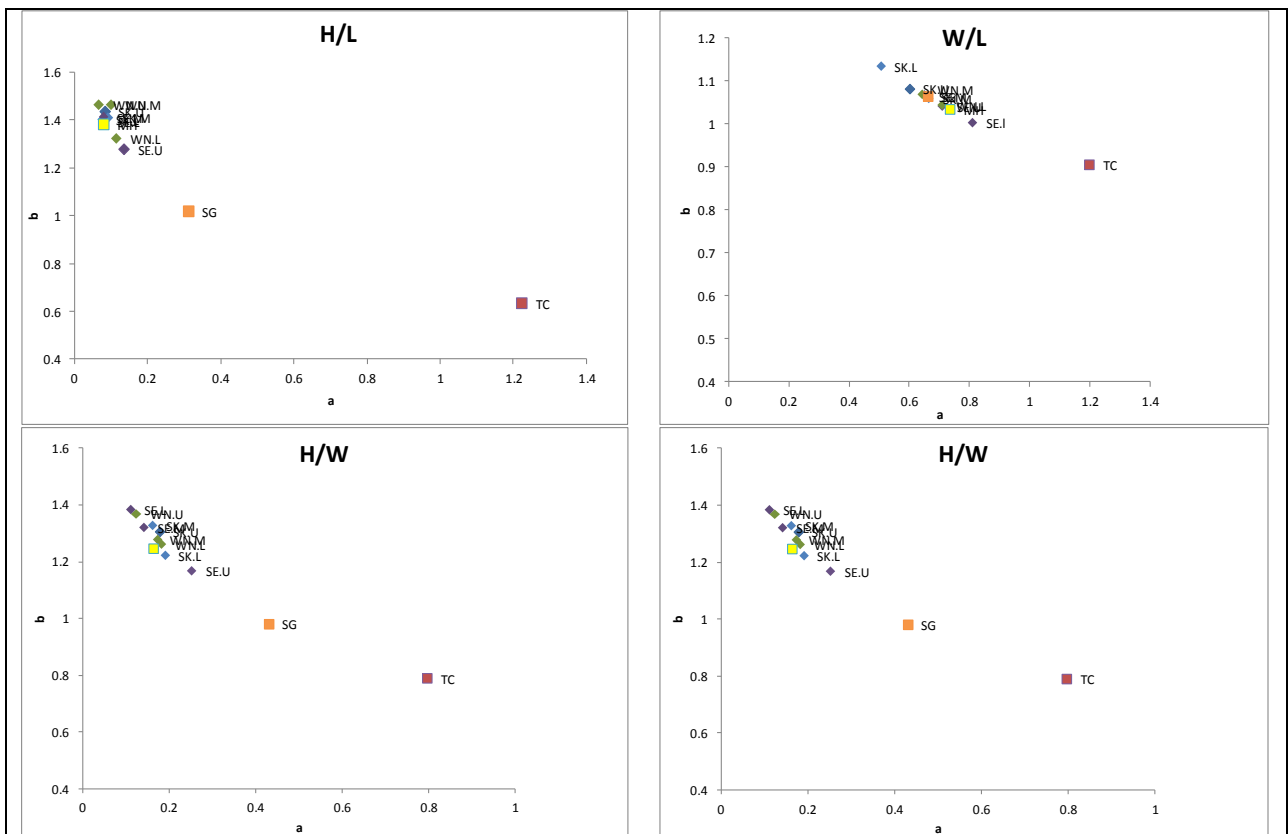


FIGURE 6: PLOTS OF 'A'/'B' VALUES

The last method used to try and relate the archaeological limpets to a particular population was to create graphs of predicted height given lengths of 15, 30 and 45mm at different sites (**FIGURE 7**).



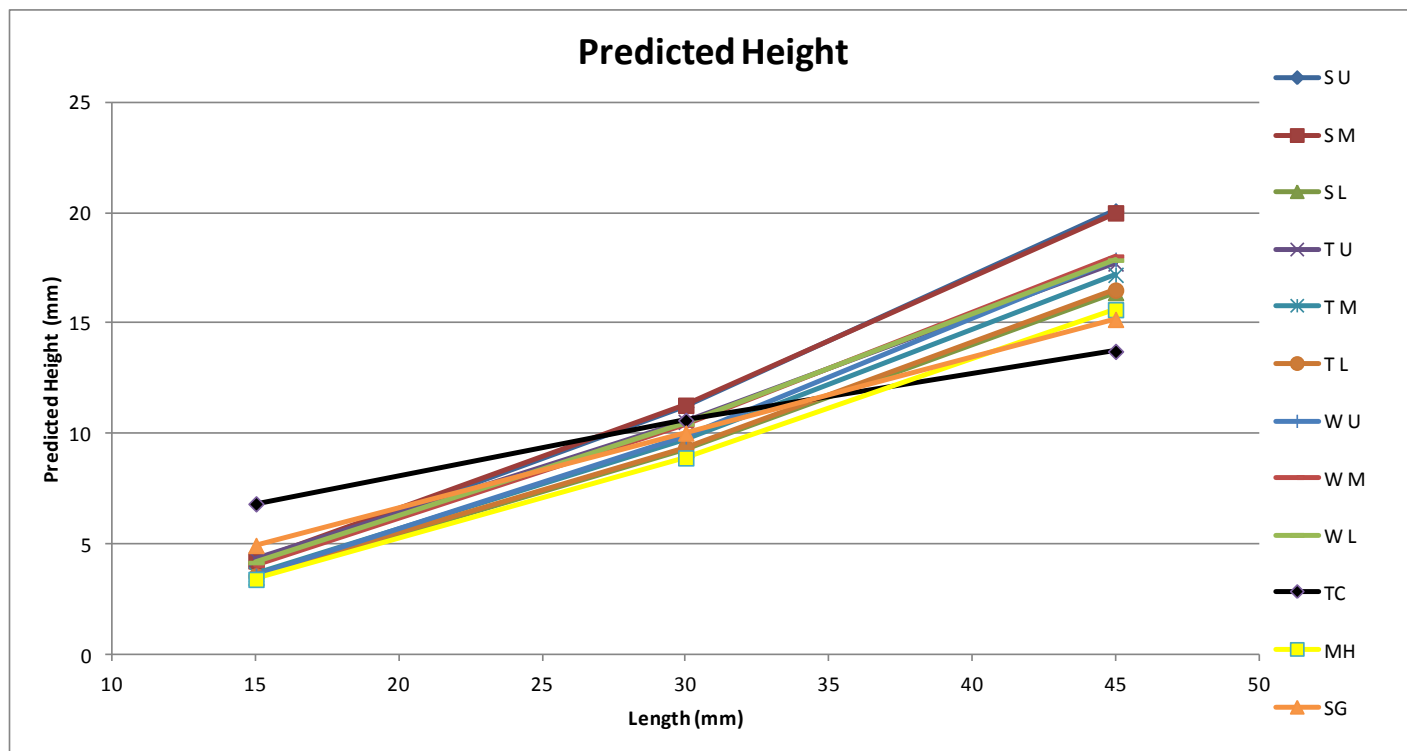


FIGURE 7: PREDICTED HEIGHT FOR DIFFERENT LENGTHS (T IS SEABAY)

These looked fairly similar for both the modern and archaeological samples so it was decided that further analysis would have to take place before differences could be seen. The squared difference between each modern and archaeological site was then calculated and tabulated (Table 3) to find the most similar modern area to each archaeological sample – the lower the number in the table, the more similar the two sites are.

	THE CAIRNS	MINEHOWE	SNUSGAR	KEY	
SKAILL – U	47.94168	25.73874	26.08074		<div>Best Match</div> <div>↓</div> <div>Worst Match</div>
SKAILL – M	46.39295	25.5289	25.28163		
SKAILL – L	19.86116	0.74532	4.106191		
SEBAY – U	22.00218	7.872987	7.011719		
SEBAY – M	22.98635	3.142647	5.879044		
SEBAY – L	19.84325	1.017453	4.091767		
WCK – U	28.34479	6.08772	9.213303		
WCK – M	26.33765	8.44348	9.111016		
WCK – L	24.12786	7.953808	7.954814		
Nearest Modern Site (In Bold)					

TABLE 3: TABLE SHOWING THE SQUARED DIFFERENCE BETWEEN PREDICTED HEIGHTS AND COLOUR-CODED TO SHOW CLOSEST MATCHES

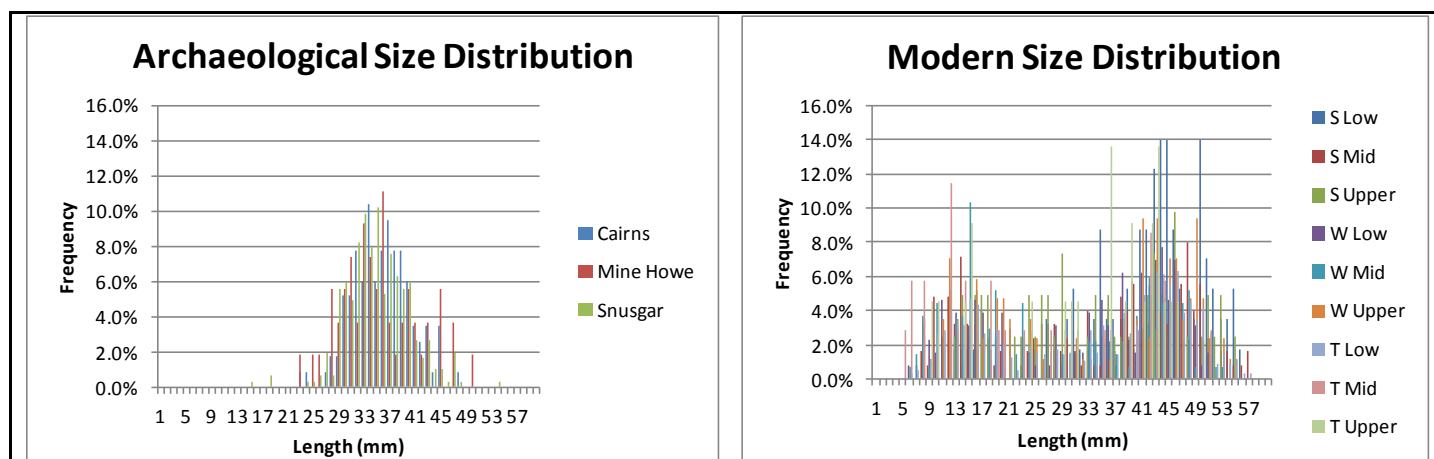
It was found that although none of the most similar modern equivalents to the archaeological samples were within the expected site, they were often close and in all of the sites, the closest modern sample was found in the lower shore. Furthermore, when comparing one particular archaeological site to one particular present day site, with only one exception (MH/W), the closest modern sample is always in the lower shore. This pattern suggests either that the limpets on the lower shore were of greater abundance so show up more in the archaeological samples, or that the gatherers were preferentially selecting the limpets of the low shore. This could be due to the fact that limpets at the low shore may be of better quality meat because they spend more time submerged so have more opportunity for feeding.

While this research has not successfully connected each archaeological site to its nearest modern site as hypothesised, it has shown some patterns in the limpet samples. The biometrics of the three modern sites did not prove as different as expected, possibly due to the fact that the sites selected were not of different enough exposure levels. However, the final table created showing the squared differences between the predicted heights of the modern and archaeological sites did show a significant pattern of the closest place to each site being at the lower shore. This suggests that the gatherers were out collecting at low tide, and also could suggest that they were preferentially selecting better quality low shore limpets.

As previously mentioned, the modern measurements may have shown more difference had three sites of more varying exposure been chosen, but these sites may not have aligned with suitable archaeological sites anyway and so could have proved even less use in this investigation. In some places human error will have crept into the measurements, as although those taken in the laboratory were available to check, the limpets measured on site were immediately replaced so any unusual measurements (other than extremely obvious error e.g. missing out the decimal point) will go undetected. These incorrect measurements, though, should be few enough in number not to significantly skew results so it is felt that these should be fairly accurate.

### EVIDENCE OF SIZE SELECTION BY GATHERERS

This subject was touched upon in the last topic, where it was concluded that it was quite possible that gatherers collected limpets at low tide in order to gain access to the larger limpets which perhaps had better quality meat due to the benefit of extra feeding time while submerged. To investigate the possibility of selection on a purely size related basis, length distribution histograms were compiled showing both the overall archaeological versus modern size distribution (**FIGURE 8**) and the size distribution of each particular site compared to its nearest modern site (**FIGURE 9**). For the purposes of these histograms, each length was rounded to the nearest whole number in order to better show the pattern occurring with less unnecessary noise. The frequency of each limpet lengths was also turned into a percentage so that each chart was comparable despite differences in original sample size.



**FIGURE 8: OVERALL ARCHAEOLOGICAL AND MODERN SIZE DISTRIBUTION**

In the overall present day compared to archaeological length distribution, a clear pattern could be seen that was also present in the separate comparison of each site. The modern day distribution charts seem to have several spikes, most notably at around 14 and 45mm, which could indicate the seasonal growth of the limpets. The modern charts range from lengths as small as only 5mm to ones as large as 57mm. In contrast, the archaeological samples have a normal bell-shaped curve and only one peak at around 35mm. The range of the archaeological samples is also smaller, with limpets only as small as 15mm, and the largest being 54mm and the next largest being only 50mm. This unusual shape suggests several things.

The lack of small limpets seems to clearly show that gatherers in the late Iron Age and Viking age were specifically selecting their limpets for size, choosing only the larger limpets and leaving the limpets to grow until they are around 15mm in length. This is probably due to the fact that these limpets would likely have been used either as part of a meal or as bait. In either case, very small limpets would not be worth the time taken to collect them, as they would contain too little meat to make a decent meal or to entice fish. In order to do either of these things with such small limpets, a very large number would need to be collected which would take more time than collecting fewer, larger limpets. However, there are other possible explanations for this pattern in the size distribution. One such explanation is that perhaps these limpets were present in the archaeological contexts when they were originally laid down, but due to their fragility have been broken up and degraded more than the larger limpets so they do not remain in large enough fragments to be measured.

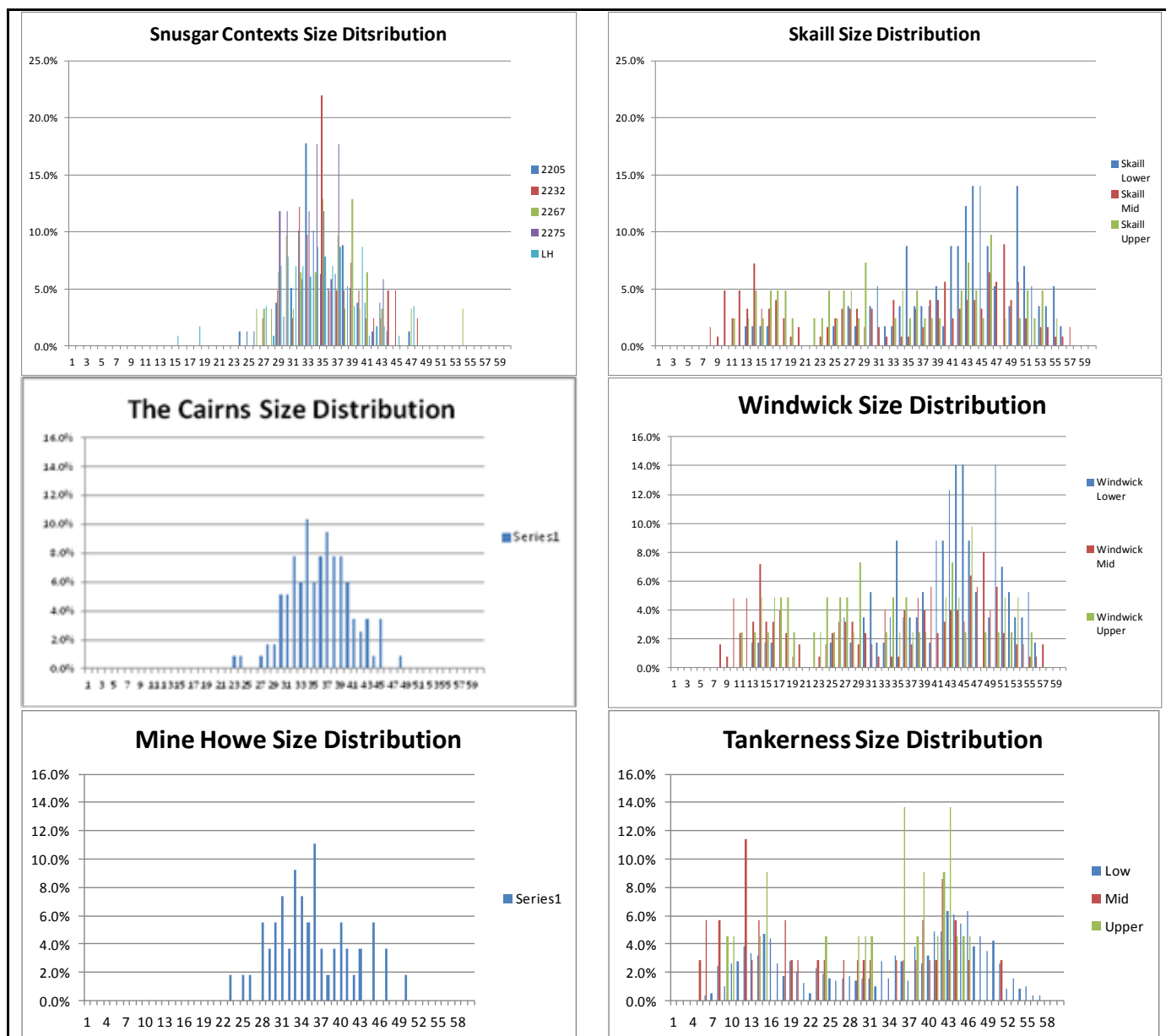


FIGURE 9: SIZE DISTRIBUTION CHARTS FOR EACH INDIVIDUAL SITE (AXES SAME AS IN FIGURE 5)

The lack of large limpets in the archaeological samples is also interesting. It is suggested that this shows the exploitation pressure placed on the limpet population by the Viking and Iron Age communities, a scenario in which these communities collect limpets so intensively that none are left to reach maturity. Again though, it is possible that these very large limpets were present originally but due to their size were more susceptible to breakages. Indeed, it can be suggested that the archaeological size distribution graph does not actually show the



sizes at which most limpets were picked, but instead show the sizes at which most limpets have survived intact, with the peak at approx. 35mm in fact representing the size at which there is the highest chance of complete preservation. When comparing the samples from these two ages, another pattern emerges in that the Iron Age samples seem to show slightly more large limpets than the Viking sample at Snusgar. This suggests either that Vikings in general were placing even more exploitation pressure on limpet populations than the Iron Age people, or that this community in particular was doing so compared to others around Orkney. The latter seems quite probable, as the settlement at Snusgar (the Viking settlement) is the closest to the sea of the three sites so would probably have been more dependent on food from coastal sources such as limpets. Here it is not so reasonable to suggest the presence of fewer large limpets at Snusgar is due to worse preservation as the very sandy soil at Snusgar gave very high levels of preservation, more so than at the other two sites, with many limpets classed as pristine or near pristine (Figure 2).

From the results provided in this topic, several conclusions can be drawn. Firstly that due to the lack of smaller limpets at all three archaeological sites it is likely that limpet gatherers from these sites chose to ignore small limpets and chose only those worth using for food or bait. The entire lack of any limpet smaller than approx. 15mm suggests that size selection is more probable than the alternative explanation - that none of the small limpets survived due to taphonomic processes - because surely even if the smaller limpets had been more quickly degraded there would still be at least some measurable remains. The same does not apply to the lack of larger limpets as there are some large outliers in the archaeological samples (see Snusgar Size Distribution chart Figure 9) however there is a possibility that these outliers are down to human error. Also, despite their larger surface area, large limpet shells do not seem as if they should degrade faster than their medium-sized counterparts as they are also much thicker. So, it seems the explanation of exploitation pressure is equally, if not more plausible than that of quick degradation. Concerning the difference between the Iron Age sites The Cairns and Mine Howe having more large limpet shells than the Viking site Snusgar, more research would have to be done in order to reach a conclusion. This could involve the selection of further sites from these two eras in order to see whether the Vikings did indeed use more limpets (thus allowing less to reach maturity) or whether it was just that particular settlement at Snusgar, due to its close proximity to the sea, which had more of a dependence upon them.

## REFERENCES

- Baxter, J.M. (1983) Allometric Relationships of *Patella vulgata* L. Shell Characters at Three Adjacent Sites at Sandwick Bay in Orkney. *Journal of Natural History*. 17(5): 743-755
- Bell, M. (2012) Analysis of Limpet Shell Shape
- Cabral, J.P. and da Silva, C.F. (2003) Morphometric Analysis of Limpets from an Iron-Age Shell Midden found in Northwest Portugal. *Journal of Archaeological Science*; 30 (7): 817-829
- Claassen, C. (1998) *Shells*, Cambridge University Press
- Want, A. (per comm) Shell Morphological Analysis of *Patella ulyssiponensis* and *P. vulgata*

---

## RECORDING BREAKAGE IN TRUE LIMPET (GASTROPODA: PATELLIDAE) SHELLS.

MATTHEW LAW<sup>2</sup>, Bath Spa University and Cardiff University

Limpets (*Patella* spp.) are frequent finds in archaeological shell assemblages from coastal sites in Europe, especially in prehistoric contexts (e.g. Shackleton and van Andel 1986; Álvarez –Fernández et al. 2011; Gutiérrez-Zugasti et al. 2011). They are common on rocky shores in the intertidal zone, where they graze seaweed. Often, their shells represent food waste. Limpets are not commonly eaten in much of northern Europe in the present day, although they remain a delicacy in the Azores (Cunliffe and Hawkins 1988, 37). Occasionally, the occurrence of limpet shells in archaeological contexts is attributed to the use of limpets as fishing bait, which is historically

---

<sup>2</sup> LawMJ@cf.ac.uk

attested in the Western Isles of Scotland (Cerón- Carrasco 2005, 42). Sharples (2005, 159) has previously argued, however, that large deposits of relatively intact limpet shells are unlikely to be waste from use in fishing, as shells used for bait are generally crushed. Furthermore, limpets used in this way are unlikely to be taken far from the shore. Limpets may also be fodder for pigs (Sharples 2005, 159).

The common limpet (*Patella vulgata*) tends to have more pointed shells at higher tidal levels, and previous work has attempted to match the ratio between length and height of the shell with position on the shore from which the limpet was harvested. As Campbell (2007) notes, however, this is not an absolute rule, as the main factors influencing shell shape are local environmental conditions rather than tidal level. Analysis of encrustations of spirorbid worms, which live below the mid tide mark and are associated with seaweed has shown that in some cases limpets that might have been interpreted as high shore species due to their shape were actually growing more pointed shells as a response to being stressed under seaweed cover (Campbell 2007; Law 2012)

Visible growth checks which occur seasonally on the outside of limpet shells have been used in some studies to estimate the age of the animals (e.g. Milner et al 2007). From analysis of oxygen isotope ratios from thin sections of *Patella vulgata* shells, these appear to form in summer in warm-temperate waters and winter in cold-temperate waters, with a mixed pattern at the boundary (Surge et al. 2013).

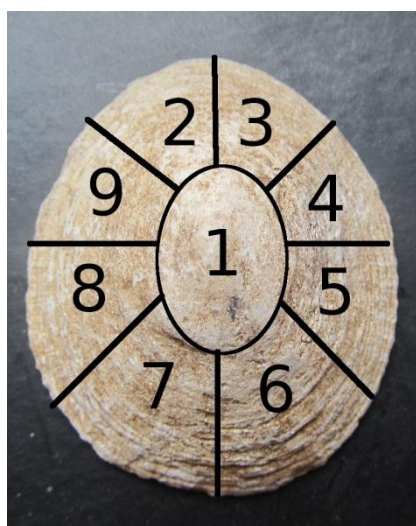


FIGURE 10: LIMPET BREAKAGE ZONES

Usually, limpets are removed from rocks with a sharp, lateral blow, although once warned they stick tenaciously. In this event, they may be levered off by inserting a blade under the animal. It is also possible to release their suction by breaking the apex (Cunliffe and Hawkins 1988, 36). The method by which a limpet has been removed may leave characteristic breaks on the shell, although post-depositional taphonomic (and peri- and post-excavation archaeological!) processes may also create similar breaks. In some cases, the presence of ingrained dirt in a break may suggest that it occurred either before or during the time the shell was in the ground, although this cannot be certain. Studying the distribution of breaks may reveal patterns that could help elucidate whether they are related to harvesting or taphonomy. Figure 1 presents the simple numerical zonation scheme I have used for (ongoing) analyses of shells from the Western Isles and Isles of Scilly, UK.

Initial, unpublished, results show some interesting patterns – at the later prehistoric site of Higher Town, St Agnes, Isles of Scilly, one particular context was overwhelmingly dominated by shells with breaks in Zone 1, perhaps suggesting collection by one individual or a group of individuals with a preference for breaking the limpet's suction by striking the apex. At the Norse Mound 2A, Bornais, South Uist, Western Isles, breaks tended to concentrate around zones 2, 3, 8 and 9, which may suggest deliberate strikes to the shell with a limpet hammer or similar object. Breaks in zones 4 and 5 are much less common at this site.

## REFERENCES

Álvarez –Fernández, E., A. Chauvin, M. Cubas, P. Arias and R. Ontañón, 2011. Mollusc shell sizes in archaeological contexts in northern Spain (13,200 to 2,600 cal BC): new date from La Garma and Los Gitanos (Cantabria), *Archaeometry*, 53 (5), pp.963-985. DOI: 10.1111/j.1475-4754.2011.00589.x.

Campbell, G., 2007. Appendix G: marine molluscs, in Galliou, P., and Cunliffe, B., (Eds.), *Les Fouilles du Yaudet en Ploulec'h, Cotes d'Armor* 3, Available online at <http://www.arch.ox.ac.uk/files/Research%20Projets/Le%20Yaudet/Volume%203%20Appendices/Ap%20G/vol%203%20ap%20g%20marine%20molluscs.pdf> [Accessed 11th February 2014].

Cerón- Carrasco, Ruby N., 2005. *'Of Fish and Men' ('De iasg agus dhaoine') : A Study of the Utilization of Marine Resources as Recovered from Selected Hebridean Archaeological Sites*. BAR British Series 400. Oxford: Archaeopress.

Cunliffe, B., and S. Hawkins, 1988. The shell midden deposits, in B. Cunliffe, (Ed.), *Mount Batten Plymouth: a Prehistoric and Roman Port* (Oxford: Oxford University Committee for Archaeology), pp. 35-38.

Gutiérrez-Zugasti, F. I., 2011. Shell fragmentation as tool for quantification and identification of taphonomic processes in archaeomalacological analysis: the case of the Cantabrian region (Northern Spain). *Archaeometry* 53, 614-630.

Gutiérrez-Zugasti, F.I., S. Andersen, A.C. Araújo, C. Dupont, N. Milner, and A.M.M. Soares, 2011. Shell middens research in Atlantic Europe: state of the art, research problems and perspectives for the future. *Quaternary International* 239, 70-85.

Law, M., 2012. Shellfish and coastal exploitation, in N. Sharples, The Beaker-period and Early Bronze Age settlement at Sligeanach, Cill Donnain, in M. Parker Pearson, ed. *From Machair to Mountains: archaeological survey and excavation in South Uist*. Oxford: Oxbow. pp. 247-250.

Milner, N., Barrett, J., and Welsh, J., 2007. Marine resource intensification in Viking Age Europe: the molluscan evidence from Quoygre, Orkney. *Journal of Archaeological Science*, 34, 1461-1472.

Shackleton, N.J., and Tj. H. van Andel, 1986. Prehistoric shore environments, shellfish availability and shellfish gathering at Franchthi, Greece. *Geoarchaeology*, 1 (2), pp. 127-143.

Sharples, N., 2005. *A Norse Farmstead in the Outer Hebrides: Excavations at Mound 3, Bornais, South Uist* (Oxford: Oxbow).

Surge, D., T. Wang, I. Gutiérrez-Zugasti and P.H. Kelley, 2013. Isotope sclerochronology and season of annual growth line formation in limpet shells (*Patella vulgata*) from warm- and cold-temperate zones in the eastern North Atlantic. *Palaios*, 28. Pp. 386-393.

---

## **SOME ADDITIONAL SHELLS FROM HORVAT SHALLALE**

**HENK K MIENIS<sup>3</sup>**, Tel Aviv University

### **ACKNOWLEDGEMENTS**

I like to thank to thank Prof. Shimon Dar (Bar Ilan University) and Dr. Liora Kolska Horwitz (Hebrew University of Jerusalem) for allowing me to study the discussed archaeomalacological material from the excavations of Horvat Shallale in 2012 and 2013.

### **INTRODUCTION**

The archaeologist Prof. Shimon Dar (Bar Ilan University) carried out a follow up excavation of Horvat Shallale in November 2012 and July 2013. During these excavations a building dated to the Early and Middle Roman period (2nd-3rd Century C.E.) was partially excavated. This resulted also in the preservation of respectively 5 and 20 samples of shells for further investigation. For the report on the molluscs from previous excavations of Horvat Shallale, Ancient City of Carmel, I refer to Mienis (2009).

### **MATERIAL AND METHODS**

Most of the archaeomalacological material had been collected either at eye-sight or with the help of a wide meshed sieve because all the shells except two were over 1 cm in size. The two smaller specimens were found stuck in the plaster present in larger shells.

---

<sup>3</sup> [mienis@netzer.org.il](mailto:mienis@netzer.org.il)

The material could be identified on the spot or in the case of the two smaller shells after comparing them with material in the National Mollusc Collection of the Hebrew University of Jerusalem.

## RESULTS

The 25 samples contained only six different species.

### GASTROPODA

#### Family Pomatiidae

*Pomatias olivieri* (de Charpentier, 1847)

Area 31B; Locus 546; Basket 2221: one shell;

Area 31B; Locus 546; Basket 2224: one shell;

Area 31B; Locus 548; Basket 2233: three shells.

#### Family Littorinidae

*Echinolittorina punctata* (Gmelin, 1791)

Area 31B; Locus 541; Basket 2202: one shell found in the white plaster present in a valve of *Glycymeris nummaria*.

#### Family Nassariidae

*Nassarius pygmaeus* (Lamarck, 1822)

Area 31B; Locus 544; Basket 2209: one shell found in the white plaster present in a valve of *Glycymeris nummaria*.

#### Family Helicidae

*Helix engaddensis* Bourguignat, 1852

Area 31AB; Locus 545; Basket 2234: one shell missing the apical whorls;

Area 31B; Locus 541; Basket 2202: one shell lacking part of the body whorl;

Area 31B; Locus 546; Basket 2221: one shell.

### BIVALVIA

#### Family Glycymerididae

*Glycymeris nummaria* (Linnaeus, 1758)

Synonym: *Glycymeris insubrica* (Brocchi, 1814)

Area 31A; Locus 526; Basket 2156: two valves;

Area 31AB; Locus 540; Basket 2208: two valves partly filled with white plaster;

Area 31AB; Locus 545; Basket 2225: five valves;

Area 31AB; Locus 545; Basket 2228: two valves;

Area 31AB; Locus 545; Basket 2234: two umbonal fragments;

Area 31B; Locus 528; Basket 2164: one valve;

Area 31B; Locus 529; Basket 2172: five valves partly filled with white plaster;

Area 31B; Locus 529; Basket 2195: six valves partly covered with white plaster;

Area 31B; Locus 530; Basket 2173: two valves partly filled with white plaster;

Area 31B; Locus 541; Basket 2202: four valves partly filled with white plaster;

Area 31B; Locus 542; Basket 2203: 12 valves;

Area 31B; Locus 544; Basket 2205: seven valves partly filled with white plaster containing several tiny specimens of the same bivalve species;

Area 31B; Locus 544; Basket 2209: 12 valves and two broken valves partly filled with white plaster;

Area 31B; Locus 544; Basket 2211: two valves;

Area 31B; Locus 544; Basket 2222: five valves, two damaged valves and one fragment of a ventral margin, most of all partly covered with white plaster;

Area 31B; Locus 544; Basket 2229: four valves, two umbonal fragments and two fragments of ventral margins;

Area 31B; Locus 544; Basket 2230: six valves and one umbonal fragment;

Area 31B; Locus 544; Basket 2235: two valves;

Area 31B; Locus 544; Basket 2241: two valve;

Area 31B; Locus 546; Basket 2221: four complete and one damaged valves;

Area 31B; Locus 546; Basket 2224: four valves;

Area 31B; Locus 548; Basket 2226: two valves;

Area 31B; Locus 548; Basket 2233: two valves and two umbonal fragments;  
Area 31B; Locus 549; Basket 2227: four valves;  
Area 31B; Locus 549; Basket 2236: six valves partly filled with plaster.

Family Cardiidae

*Acanthocardia tuberculata* (Linnaeus, 1758)

Area 31B; Locus 544; Basket 2235: one fragment.

## DISCUSSION

### *Origin*

The studied material consisted of shells which originated from two different areas. The land snails among them (*Pomatias olivieri* and *Helix engaddensis*) are still living in the immediate surroundings of the excavated building, while the marine gastropods (*Echinolittorina punctata* and *Nassarius pygmaeus*) and bivalves (*Glycymeris nummaria* and *Acanthocardia tuberculata*) are commonly found on the nearby beaches of the Mediterranean Sea.

### *Utilization*

All the marine shells without any exception had probably been used as building material. A large proportion of the *Glycymeris* valves were still filled with a whitish plaster containing large sand grains, two small marine gastropods (*Echinolittorina punctata* and *Nassarius pygmaeus*) and a few tiny specimens of *Glycymeris nummaria*.

## CONCLUSION

According to the preserved archaeomalacological material marine shells and sand collected from the Mediterranean beach had been exploited as building material at Shallale during the Early and Middle Roman period. The few land snails found during the excavation are probably natural intruders, most probably from more recent times.

## REFERENCES

Mienis, H.K., 2009. A report concerning the shells from the excavation of H. Shallale. In S. Dar (Ed.): Shallale; Ancient City of Carmel. BAR International Series, 1897: 421-426.

---

## RECENT RADIOCARBON DATES FOR OCCUPATIONS OF SIRIKI AND WYVA CREEK SHELL MOUNDS, NORTHWESTERN GUYANA

MARK G. PLEW<sup>4</sup>, Boise State University

Unique within the Guianas (Rostain 2008), the coastal plain of northwestern Guyana is characterized by a number of Archaic-age shell mounds. The mounds, which are accumulations of shell refuse, served as living areas and as places for burials. Though small mammals, crabs, and fish occur, shellfish debris— is primarily of the striped snail (*Neritina zebra*). Common to the archaeological assemblages recovered from shell mounds are chipped and groundstone artifacts of the so-called pre-ceramic Alaka phase which was originally dated between 1950 and 1450 B.P. (Evans and Meggers 1960). During dry intervals of the late Pleistocene these areas lay some 100 kilometers seaward (Williams 2004, Plew 2010) and would have, as Williams (1998 ) has argued resulted in the shifting and alternating opportunistic use of brackish and freshwater species. Radiocarbon dates indicate pre-ceramic occupations of a number of shell midden deposits as early as ca. 7300 B.P. (Williams, 1981, 1998, 2004). Some mounds including Barabina (Williams 1981) and Kabakaburi (Plew, Pereria and Simon 2007) contain early ceramic remains—the former, the focus of a debate regarding the earliest presence of pottery in northwestern Guyana (Williams 1996, 1997 and Roosevelt 1997). Though shell mounds are not found in adjacent Suriname and French Guiana they are common in the Mina phase culture near the mouth of the Amazon

---

<sup>4</sup> mplew@boisestate.edu

where pottery at Taperinha and Pedra Pintada date 7030 B.P. and 7550 B.P. respectively (Roosevelt 1991, 1995, 1997).

Wyva Creek shell mound was reported to staff of the Walter Roth Museum of Anthropology (WRMA) and was visited by Gerard Pereira, Archaeological Staff, WRMA in March, 2009. The site had not been previously reported by Evans and Meggers (1960) or others. Pereira reported the site to be quite large and impacted by commercial shell removal. Wyva Creek is located some 10 miles north on the Barama River of the confluence of the Waini and Barama Rivers and some 8 miles up Wyva Creek which empties into the Barama River from the east. The area is heavily forested with high canopy and some mangrove swamp. Soils are lateritic with some rock outcroppings near and above Wyva Creek. There is heavy humic accumulation in and about the site area.

The Wyva Creek mound appears to be one of the larger shell mounds recorded in Guyana. The mound measures 27 x 28 meters and is approximately 8 meters at its highest point. The mound is relatively steep as are the mounds at Piraka and Waramuri. The southern portion of the mound slopes more gradually into the forest creating an elevational difference between the highest point (8 meters) and its lowest elevations that are no more than one to two meters in height. The greatest post-depositional impact to the mound is the commercial removal of shell from the western one-quarter of the midden where shell has been removed to near the original ground surface. A small perimeter remnant of the mound is noticeable on the northern and eastern edges of the impacted area. Though the size of the mound prevented extensive excavation, the stratigraphic profile created by the commercial removal of shell provided evidence of numerous probably short-term uses of the location.

Though there appear to be three major cultural lenses associated with basin-shaped fire hearths measuring approximately one meter in diameter and 10-20 cm in thickness these probably, as suggested, represent a series of events rather than continuous or extended occupation. There is no evidence of structures. Charcoal from Feature A, a fire hearth occurring between 1.6 and 2.0 meters below surface was submitted for radiocarbon analysis and returned a conventional radiocarbon age of 6340 $\pm$ 50 B.P. (Beta-264970)—calibrated age of 7410-7350 B.P.—making the mound one of the oldest in the northwest and possibly of the age of the Piraka Mound (Williams 2004).

The Siriki shell mound is located on Siriki Creek approximately four miles up a west running estuary of the Pomeroon River. Siriki Creek and the Pomeroon River are situated within the Guyana coastal plain which is generally flat and approximately 1.5 meters below sea level at high tide. Early explorations were conducted by Brett, who in 1868 excavated 5 test pits (dimensions unknown). He reports having found extensive shell refuse and human remains. Evans and Meggers (1960:38) who visited the location during their survey of then British Guiana reported the mound's dimensions as 250 feet long by 90 feet wide and 20-25 feet high. The exact location of the mound remained unknown until recently revisited in March 2011 by a survey team from the Walter Roth Museum of Anthropology (Daggers, Sobers and Austin, 2011). The mound is presently 5.2-4.4 meters at greatest height, 62 meters at greatest length and 36 meters at its maximum width. The Siriki mound contained evidence of living surfaces, fire hearths and the remains of nine individuals that include two adult males in an age range of 15-23. The remains do not exhibit Harris lines, dental hypoplasias or other pathologies.

Two radiocarbon samples were submitted to Beta Analytic, Inc. One sample (Beta 309315) consisting of organic sediment was collected from the base of the mound at a depth of 120-140 cm bpd. This sample returned a date of 4140 $\pm$ 30 B.P. (2-sigma calibration: Cal BP 4820-4750 and Cal B.P. 4730-4530). A second sample consisted of charred material (Beta-307549) from level 40-60 cm below datum. The sample returned a date of 270 $\pm$ 30 B.P. (2-sigma calibration: Cal B.P. 420-410, Cal B.P. 320-280). While the early date is well within the range for shell mounds, the radiocarbon date of 270 B.P. is considerably more recent than expected. Though it is possible that the date is unreliable, it may reflect a more recent presence of nitrites in the area than formally believed or the late period use of shell mounds for habitation.



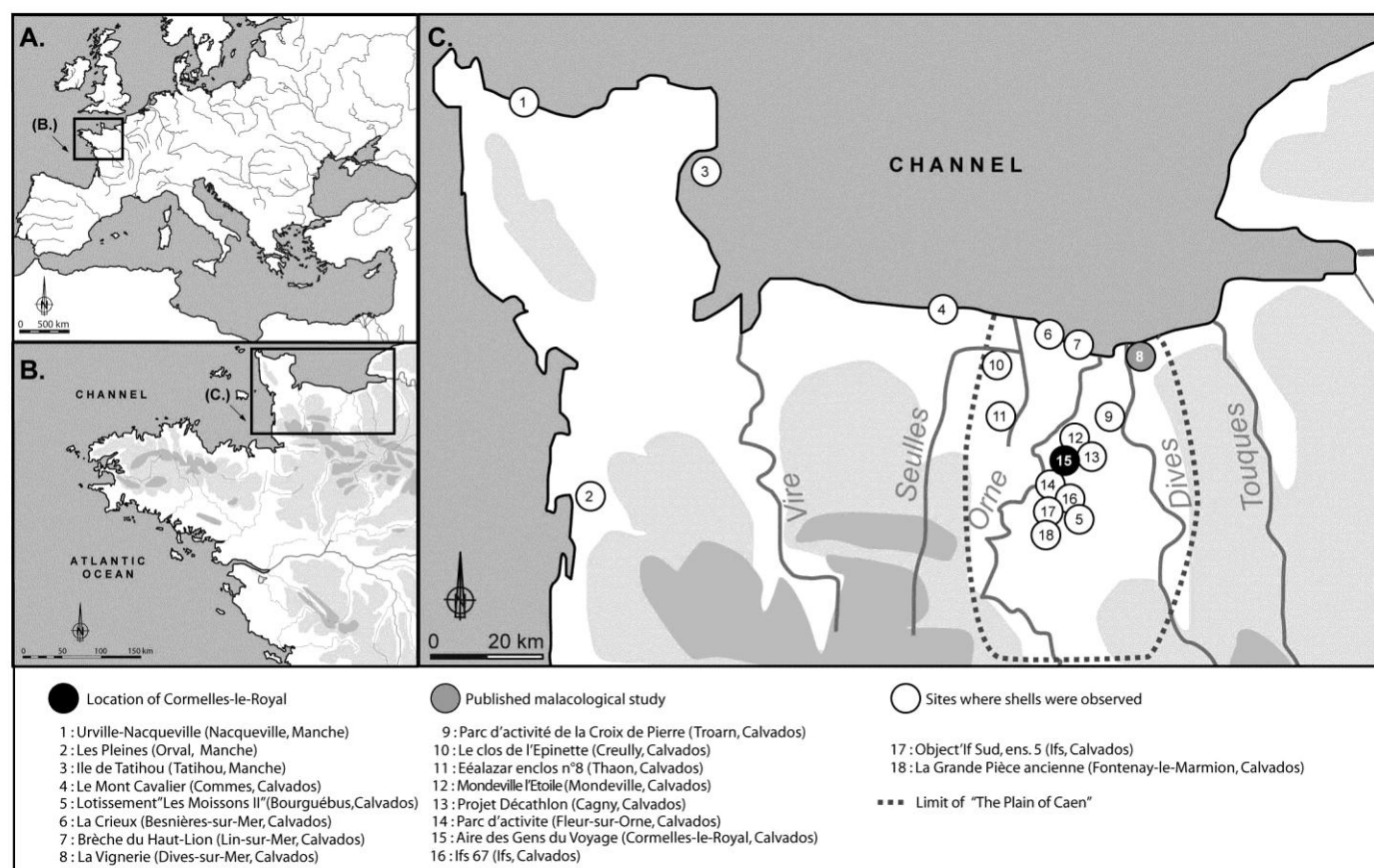
## REFERENCES

- Evans, CA. and B. J. Meggers 1960. Archeological Investigations in British Guiana. Bureau of American Ethnology. Bulletin 197. Smithsonian Institution, Washington D.C.
- Daggers, Louisa, Yannock Sobers, and Everly Austin. 2010. Siriki Shell Mound Survey. Report on File, Walter Roth Museum of Anthropology. Georgetown.
- Plew, Mark G. 2005. The Archaeology of Guyana. British Archaeological Reports International Series No. 1400. Archaeopress: Oxford.
- Plew, Mark G., Gerard Pereira and George Simon. 2007. Archaeological Survey and Test Excavations of the Kabakaburi Shell Mound, Northwestern Guyana. Monographs in Archaeology No. 1, University of Guyana.
- Plew, Mark G., and Christopher Willson. 2009. Archaeological Test Excavations at Wyva Creek, Northwestern Guyana. Monographs in Archaeology No. 3, University of Guyana.
- Plew, Mark G. 2010. Pleistocene-Early Holocene Environmental Change: Implications for Human Adaptive Responses in the Guianas. In *Anthropologies of Guayana: Cultural Spaces in Northeastern Amazonia*, edited by Neil L. Whitehead and Stephanie W. Aleman, pp. 23-35, University of Arizona Press.
- Roosevelt, A. C. 1995. Early Pottery in the Amazon: Twenty Years of Scholarly Obscurity. In *The Emergence of Pottery: Technology and Innovation in Ancient Societies*, W. Barnett and J. Hoopes, editors, pp. 115-132. Washington, D.C.: Smithsonian Institution Press.
- Roosevelt, A. C. 1997a. The Demise of the Alaka Initial Ceramic Phase Has Been Greatly Exaggerated: Response to D. Williams. *American Antiquity* 62(2):353- 364.
- Roosevelt, A. C., 1997b. Paleoindian and Archaic Occupations in the Lower Amazon, Brazil: A Summary and Comparison. In *Explorations of American Archaeology: Essays in Honor of Wesley R. Hurt*, Mark G. Plew, editor, University Press of America, Lanham, Maryland.
- Roosevelt, A. C., R. A. Housley, M. Imazio da Silveira, S. Mananca and R. Johnson. 1991. Eight Millennium Pottery from a Prehistoric Shell Midden in the Brazilian Amazon. *Science* 254:1621-1624.
- Williams, D. 1981. Excavation of the Barabina Shell Mound North West District: An Interim Report. *Archaeology and Anthropology* 2(2):125-140.
- Williams, D. 1982. Some Subsistence Implications of Holocene Climate Change in Northwestern Guyana. *Archaeology and Anthropology* 5(2):83-93.
- Williams, D. 1996. The Mabaruma Phase: Origin Characterization and Chronology. *Archaeology and Anthropology* 11.
- Williams, D. 1998. The Archaic Colonization of the Western Guiana Littoral and Its Aftermath. *Journal of Archeology and Anthropology* 12(1): 22-41.
- Williams, D. 2004. Prehistoric Guiana. Ian Randle Publishers, Kingston
- Williams, D. n.d. Radiocarbon Date from Akawabi. Notes on file, Walter Roth Museum of Anthropology.
-

**EXPLOITATION OF MARINE SHELLS DURING THE LATE IRON AGE:  
GATHERING TERRITORY, DIETARY CHOICES AND CIRCULATION NETWORKS  
"THE EXAMPLE OF CORMELLES-LE-ROYAL (PLAIN OF CAEN, LOWER-NORMANDY, FRANCE)"  
CAROLINE MOUGNE, CATHERINE DUPONT, HUBERT LEPAUMIER AND LAURENT QUESNEL**

## INTRODUCTION

The role of marine invertebrates (shell, crustacean and urchin) in the diet of Late Iron Age populations in Lower-Normandy (north-western France) is still little-known although the presence of these animals is quite common on many protohistoric sites, particularly for the Plain of Caen (**FIGURE 1**) (Dupont 2006a ; Carpentier 2007, 2009; Jahier 2009 ; Mougne *et al.* 2013). In this area, for fifteen years, there have been a number of building programs, which have led to numerous preventive archaeological excavations (Lepaumier *et al.* 2010 ; Vauterin *et al.* 2010). These excavations have revealed a dense human settlement dated to the Late Iron Age. Most of these sites, sometimes as far as 30 kilometers from the present seashore (**FIGURE 1**), are characterized by the presence of marine invertebrates sometimes in large quantities.



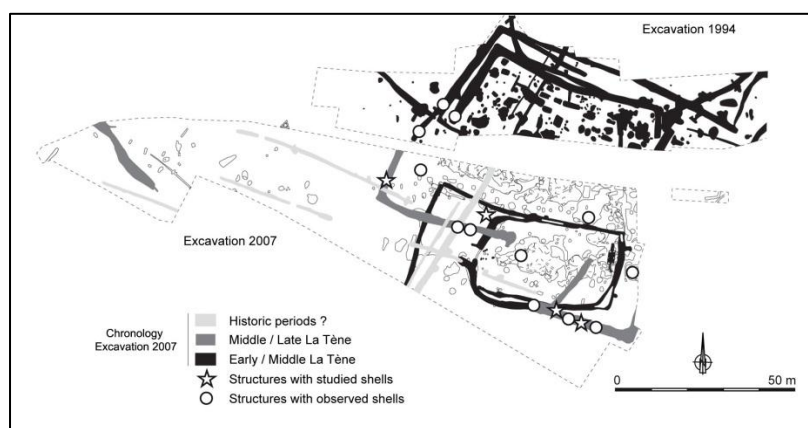
**FIGURE 1: DISTRIBUTION MAP OF THE ARCHAEOLOGICAL SITE OF CORMELLES-LE-ROYAL AND OTHER CONTEMPORARY SITES DATED TO LATE IRON AGE WHERE MARINE SHELLS WERE OBSERVED (CAD L. QUESNEL, C. MOUGNE)**

Such is the case for Cormelles-le-Royal, which is located in the Plain of Caen, 20 kilometers away from the coast and dated to the Late Iron Age (4th- 2nd century BC). Two preventive excavations were undertaken at the site: one in 1994 on the northern part under the direction of V. Carpentier (Carpentier *et al.* 2002 ; Carpentier 2006) and another one in 2007 on the southern part under the direction of H. Lepaumier (Lepaumier 2009) (figure 2). The archeologists discovered an enclosure of Late la Tène Age. It measured 6000 m<sup>2</sup> and was delimited by ditches of 1.60 meters depth and 2.40 meters wide. The artifacts found in this site illustrate some daily activities like spinning, weaving, blacksmithing and production of sea salt. The assemblage of animal bones is important, with 3450 remains. Unfortunately, a detailed study has not yet been completed. The site of Cormelles-le-Royal is similar to other contemporary sites of the Plain of Caen in terms of its artifacts, its preservation conditions and the context of abandonment. It presents a very large concentration of structures (Carpentier *et al.* 2002 ; Lepaumier, 2009), some of them used for storage.

Cormelles-le-Royal is one of the few inland sites where the marine invertebrates have been studied. Thus we have opportunity to address a number of important questions. How and where did the inhabitants gather the shells and others marine invertebrates? Which species did they consume and in what quantities? Were marine resources a delicacy or an ordinary food? Was the consumption of shells connected to a specific status represented at the site? What were the circulation networks? Can we define the organization of the activities and of the persons linked to the exploitation of marine products? Does the distribution of the marine invertebrates remains inside the enclosure reveal specific management of marine waste? The studies of the terrestrial fauna in the Plain of Caen for the Late Iron Age show that animals were not only used for daily food but also consumed during rituals, like banquets, or used as part of ritual deposits (Auxiette *et al.* 2010). Was this also the case for marine invertebrates?

## MATERIALS AND METHODS

The totality of the studied sample comes from the southern part excavated in 2007. Four sedimentary samples from the Late Iron Age horizon (40 litres in total) were taken, three from ditches and one from a pit (**FIGURES 2 AND 3**). These samples were sieved with fresh water and fine meshes (2 mm) and sorted in the CReAAH (Centre de Recherche en Archéologie Archéosciences Histoire) laboratory in 2011. This protocol allowed us to identify species that were highly fragmented or were too small to be easily seen.



**FIGURE 2: PLAN OF THE ARCHAEOLOGICAL SITE OF CORMELLES-LE-ROYAL (CAD H. LEPAUMIER)**



**FIGURE 3: A SHELL DEPOSIT INSIDE THE PIT F. 174 AT CORMELLES-LE-ROYAL (CL. D. THIRON)**

Identification of the shells (gastropods, bivalves and scaphopods) was carried out using the comparative collection of the CReAAH (Comparative collection Gruet & Dupont, UMR 6566-CReAAH). Identifications were then confirmed using reference works on molluscs (gastropods and bivalves) (Hayward and Ryland 1995; Poppe and Goto 1991, 1993; Quérou and Vayne 1998; Audibert and Deleamarre 2009). Scientific names used to describe the identified marine molluscs correspond to the standards of the CLEMAM "Check List of European Marine Mollusca", the database used by the National Museum of Natural History of Paris (2011). Several methods of counting were used to calculate the relative proportion of each species. The NISP (Number of Identified Specimens; Grayson 1984) corresponds to all the identified remains larger than to 2 mm. Minimum Number of Individuals (MNI) was also used for quantification of the shells. For bivalves, a MNI by combination is obtained through separating left and right valves according to the position of the teeth of the hinge, the ligament and the pallial sinus line (McCarthy *et al.* 1999; Dupont 2006b). For the coiled gastropods, calculating the MNI is associated with the presence of the peristome (Dupont 2006b). Finally, the remains of each species were weighed (in grams). Next, shells were measured with a digital calliper graduated in millimetres (0.01) according to the procedures established by C. Dupont (2006b). Metric data were gathered for mussels (*Mytilus edulis*) and common cockles (*Cerastoderma edule*). Nevertheless, the fragmentary state of the valves of mussel and the small quantity of remains of other species limited the taking of measurements. Some measurements of various parts of the valves of mussels were also taken for future reconstructions. Metric-focused research is on-going and the results will be presented in future (Mougne, in progress).

## RESULTS

### *Faunal spectrum*

Eighteen species of marine shells (13 bivalves, 4 gastropods and 1 scaphopod) and two crustaceans were identified (**TABLE 1, FIGURE 4**) for the site of Cormelles-le-Royal.

The mussels (*Mytilus edulis*) represent the vast majority of the marine shells remains for the three types of quantification used (99 % of the NISP, 96 % of the MNI and 99 % of total Weight of shells). The high percentage of the NISP of this species is the result of high levels of fragmentation. Indeed, the relationship of Weight / NISP (6741/444085) shows that the average weight of a mussel remains at Cormelles-le-Royal is approximately 0,01g. The relationship of NISP / MNI (444085/2937) shows that for each individual, 151 fragments are present. These two markers confirm the high level of fragmentation seen in mussels on this archaeological site. This is not uncommon (Light 2005; Bardot 2010,146). Their shell is very thin and it resists poorly to mechanical pressure. This fragmentation does not seem to be due to human activity. The mussels are sometimes so weak that it is very difficult to collect them. The poor preservation of the mussels may have discouraged some archaeologists, who thought it was impossible to obtain informations from these highly fragmented shells. Given the fragmented state of the shell samples, it was necessary to work from sedimentary samples. A methodological approach was designed for such mussel remains at the Mesolithic site of Beg-er-Vil (Dupont 2006b, 187-190). The results show a distortion of the quantifications between a simple hand-sorted collection strategy (NISP = 11; MNI = 5) and sieved samples with meshes of 2 millimeters (NISP = 13176; MNI = 1113) (Dupont 2006b, 187-190). The difference between the two methods is highly significant and clearly shows the utility of the sieving with fine meshes. In spite of this high fragmentation at Cormelles-le-Royal, a hundred valves were found complete, which allowed some complete valve measurements to be taken. Only the consumption of this shell is really attested on the site.

Thirteen other identified marine shells are edible and may have contributed to the diet of the inhabitants of Cormelles-le-Royal (**FIGURE 4**): the common cockles (*Cerastoderma edule*) (1: L= 25 mm, 2: L= 10 mm, 3: L= 11 mm, 4: L= 18 mm, 5: L= 16 mm, 6: L= 21 mm, 7: L= 25 mm, 8: L= 14mm), the common winkle (*Littorina littorea*) (1: L=19 mm, 2: L=15mm), the dogwhelk (*Nucella lapillus*) (L=28mm), the prickly cockle (*Acanthocardia echinata*) (L=30mm), the solen (*Solen marginatus*), the surf clam (*Spisula solida*), the Balthic clam (*Macoma balthica*) (L=19mm), the bean clam (*Donax* sp.), the peppery furrow shell (*Scrobicularia plana*), the white piddock (*Barnea candida*), the oyster (*Ostrea* sp.) and the trough shell (*Macra* sp.).

"Incidental species" are also present at Cormelles-le-Royal. These species were transported involuntary to the site with algae, mud, sand, on or inside other shells. Six species were identified: the white furrow shell (*Abra alba*), the rayed trough shell (*Macra corallina*) (L=3mm), the nuclear nut clam (*Nucula nucleus*), *Euspira* sp. (L=9mm), the laver spire shell (*Hydrobia ulvae*) (L=4mm) and the tusk shell (*Dentalium* sp.) (**FIGURE 4**). The small size of these shells, between 3 and 9mm, seems to indicate that these molluscs were not consumed by humans. They were involuntarily brought on the site, perhaps with other shells like mussels.

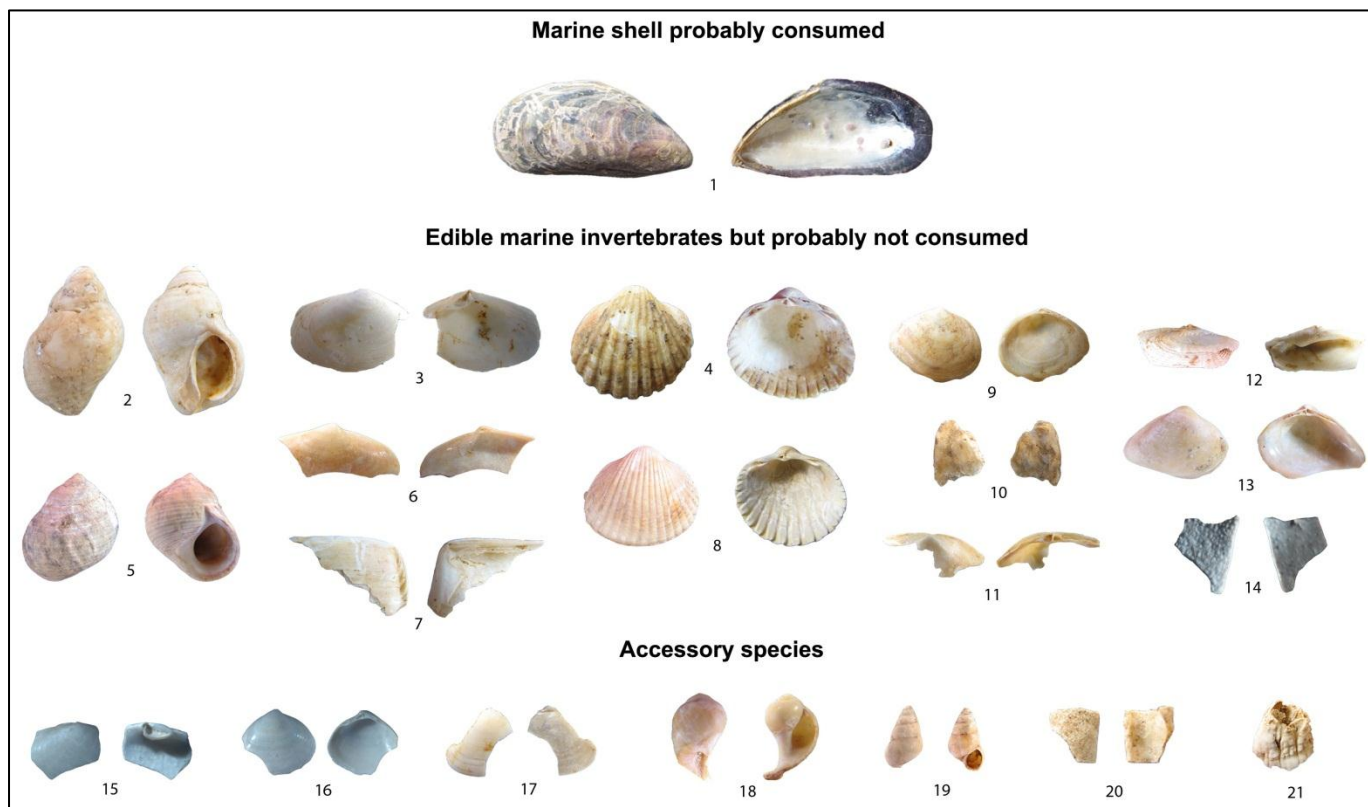
Latin name	NISP	VD	VG	MNI	Weight (g)
<b>BIVALVES:</b>					
<i>Mytilus edulis</i>	444085	2824	2937	2937	6741
<i>Solen marginatus</i>	2	1	1	1	1.86
<i>Acanthocardia echinata</i>	1	0	0	1	2.73
<i>Cerastoderma edule</i>	58	14	19	19	11.3
<i>Cerastoderma</i> sp.	70	0	0		1.55
<i>Scrobicularia plana</i>	171	3	10	10	3.68
<i>Macoma balthica</i>	10	9	1	9	0.51
<i>Spisula</i> sp.	29	18	4	18	0.58
<i>Mactra corallina</i>	5	5		5	0.05
<i>Mactra</i> sp.	17	7	5	10	0.45
<i>Barnea candida</i>	238	10	14	14	6.74
<i>Donax</i> sp.	62	8	4	8	1.52
<i>Nucula nucleus</i>	1	0	0	1	0.02
<i>Abra alba</i>	4	4	0	4	0.01
<i>Abra</i> sp.	3	3	0	3	1.02
<i>Ostrea</i> sp.	3	0	0	1	0.03
Cardidae	7	0	0		0.08
Mactridae	107	0	0		0.8
Pteriomorpha	1	0	0	1	0.02
Unspecified bivalve	89	0	0		0.35
<b>GASTÉROPODS:</b>					
<i>Nucella lapillus</i>	1	-	-	1	3.09
<i>Littorina littorea</i>	7	-	-	7	4.13
<i>Euspira</i> sp.	1	-	-	1	0.08
<i>Hydrobia ulvae</i>	1	-	-	1	0.01
<b>SCAPHOPODS:</b>					
<i>Dentalium</i> sp.	1	-	-	1	0.01
Unspecified shell	5	-	-		0.05
<b>CRUSTACEAN:</b>					
<i>Balanus</i> sp.	6141	-	-	1028	109
Unspecified crab	10	-	-	1	0.05
<b>Marine Invertebrates total</b>	<b>451130</b>			<b>4082</b>	<b>6889.17</b>

TABLE 1: SPECTRUM OF MARINE INVERTEBRATES IN LATE IRON AGE HORIZONS AT CORMELLES-LE-ROYAL (VD : RIGHT VALVES; VG : LEFT VALVES)

A single crab, decapod crustacean, was found. It is however difficult to say if this crustacean was consumed because the species cannot be identified and the remains did not allow for the estimation of the original size of the specimen. Barnacles, belonging to the order of cirriped crustaceans, were also identified in large numbers (25 % of MNI of marine invertebrates) (TABLE 1, FIGURE 4 n°21). Some whole barnacles and some impressions of barnacles were identified on mussels. Some of them also present evidence of burning (NISP=40). They were probably brought to the site attached to mussels.

Apart from the mussels, the consumption of other marine invertebrates remains speculative. Many of these species are only represented by a single individual or shells of small sizes.





**FIGURE 4: MARINE INVERTEBRATES IDENTIFIED AT CORMELLE-LE-ROYAL (CAD C. MOUGNE)**

**1:** *Mytilus edulis* (L=58mm), **2:** *Nucella lapillus* (L=28mm), **3:** *Scrobicularia plana* (L=15mm), **4:** *Acanthocardia echinata* (L=32mm), **5:** *Littorina littorea* (L=18mm), **6:** *Donax* sp. (L=15mm), **7:** *Solen marginatus* (L=24mm), **8:** *Cerastoderma edule* (L=25mm), **9:** *Macoma balthica* (L=18mm), **10:** *Ostrea* sp. (L=7mm), **11:** *Mactra* sp. (L=16mm), **12:** *Barnea candida* (L=18mm), **13:** *Spisula* sp. (L=20mm), **14:** Unspecified Crab (L=5mm), **15:** *Abra alba* (L=4mm), **16:** *Mactra corallina* (L=3mm), **17:** *Nucula nucleus* (L=7mm), **18:** *Euspira* sp. (L=9mm), **19:** *Hydrobia ulvae* (L=4mm), **20:** *Dentalium* sp. (L=3mm), **21:** *Balanus* sp. (L=11mm)

### Gathering Strategies

The site of Cormelles-le-Royal is located twenty kilometers away from the coast. Recent studies carried out in the lower Dives valley (**FIGURE 1**) suggest a marine transgression from around the 6th century and a remarkable change probably around the 2nd–1st century BC (Lespez *et al.* 2010). Indeed, a significant landward migration of the tidal influence in the inner part of the estuary, up to 20 km from the sea, and a considerable enlargement of the estuary have been identified for this period (Lespez *et al.* 2010). It is likely that the Orne estuary, located to the left of the Dives, saw similar transformations.

The inhabitants thus had to move occasionally to specific places in order to collect shells. The gathering strategies reflected the values attributed to each shell: taste, taboo food, material, symbolic and other environmental parameters such as accessibility and abundance on the seashore.

The inhabitants seem to have exploited mainly rocky to muddy-rock shores (97 % of MNI of marine shells) (**TABLE 2**). This is in light of the numerical dominance of the mussel, the most consumed shell on the site, which lives in the intertidal zone, down to 10 meters depth along the coast. People could easily collect them on the seashore. Mussel gathering is quite straightforward because it is visible to the naked eye and collected by hand or with a tool to cut its byssus, in clusters or by individual. It is eaten all year round but it is fleshier during the reproductive period, between March and October (Pope and Goto 1993).



Species	Substrate	Tidal range			
		Intertidal			Eulittoral
		High	Middle	Low	
<i>Nucella lapillus</i>	Rock				
<i>Littorina littorea</i>					
<i>Mytilus edulis</i>	Rock and Mud				
<i>Barnea candida</i>					
<i>Ostrea</i> sp.					
<i>Hydrobia ulvae</i>					
<i>Donax</i> sp.	Sand				
<i>Spisula</i> sp.					
<i>Mactra</i> sp.					
<i>Euspira</i> sp.					
<i>Mactra corallina</i>					
<i>Acanthocardia echinata</i>					
<i>Macoma balthica</i>					
<i>Solen marginatus</i>	Sand and Mud				
<i>Cerastoderma edule</i>					
<i>Nucula nucleus</i>					
<i>Abra alba</i>					
<i>Dentalium</i> sp.					
<i>Scrobicularia plana</i>	Mud				

TABLE 2: SHORELINE POSITIONS AND SUBSTRATES OF MARINE SHELL SPECIES (GREY CELL: POTENTIAL PRESENCE; AFTER DUPONT 2006B)

The fragmentation of mussels is a major feature at many archaeological sites. Thus, it is often difficult to obtain total lengths and to describe the gathering strategies. There are 70 whole valves (VD=30; VG=40) from the site of Cormelles-le-Royal among the 5761 valves counted (TABLE 1); from these, a correlation has been established in order to reconstruct the original size of fragmented valves. The results show a significant link between the total length and the length of hinge with a correlation coefficient (R) of 0.96. From these results, 365 mussels whose hinges were intact have been converted. 365 total lengths (VD = 193; VG = 172) have thus been reconstructed, which means an increase of 255% of the metric dataset. The mean length of *Mytilus edulis* (VD= 223; VG=212) is 44mm (FIGURE 5). Additionally, the umbones of mussels identified (part in front of the valve) are all adults and juveniles are absent. The inhabitants thus selected large-size mussels probably for food.

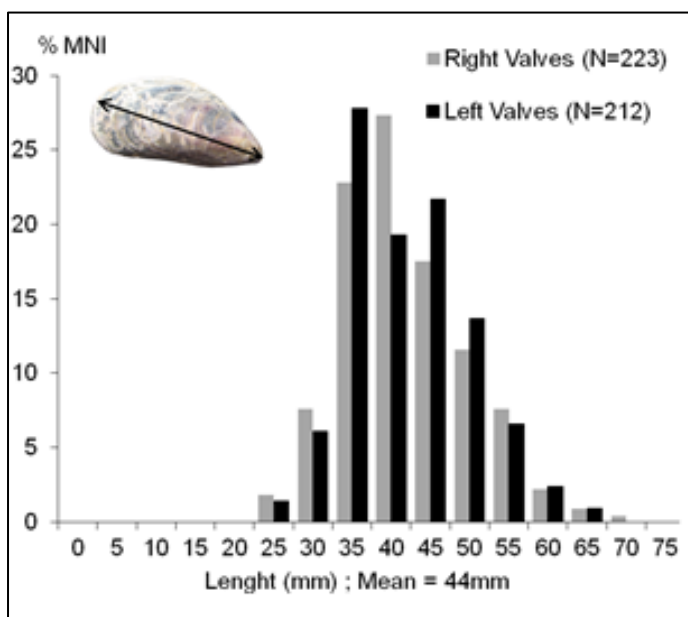


FIGURE 5: DISTRIBUTION OF LENGTH CLASSES (MM) OF MYTILUS EDULIS (MUSSEL) AT CORMELLES-LE-ROYAL

Shells living in sandy (2.7 % of MNI) and muddy (0.3 % of MNI) substrates were rarely exploited (**TABLE 2**). They could have been trapped within a mussel-bed and transported during the gathering and the transport of mussels to Cormelles. Indeed, four shells (*Abra alba*, *Dentalium* sp., *Macra corallina* and *Acanthocardia echinata*) were only accessible in the eulittoral zone, beyond tidal exposure and accessible by feet, by boat or by snorkelling. It is therefore very likely in view of the small quantity or/and the small size of these species that they arrived dead on the seashore and were then transported to the site with other marine products. The cockle (*Cerastoderma edule*) was collected from sandy substrates, in the intertidal zone during low tide. This bivalve is buried under soft sediments and leaves small holes on the surface. It is gathered with a tool or by hand. The lengths of the cockles at Cormelles show the selection of small individuals between 11 to 25mm with a mean of 18mm. Given the small sizes of the few individuals identified, this shell was probably not collected by the inhabitants.

#### *From gathering to consumption*

After being gathered, the shells were transported to the site of Cormelles-le-Royal, twenty kilometres inland. The transport may have been undertaken by boat, considering the fact that the Orne river was navigable during Protohistory; or by land by means of a horse or a chariot. It took a day minimum to go and return. The mussels can not survive at a temperature exceeding 25°C, which makes their transport difficult in summer.

The large number of barnacles (25 % of MNI) and small shells found in the shell deposits seem to indicate that the preparation or preserving of shells were probably done on site. Nevertheless, we can not exclude that the mussels were preserved before their transport. The shellfishes collected were either eaten directly or processed so as to be consumed later. There are several different ways to preserve the meat: it can be dried in the sun (with or without the shell), smoked and stored in jars or in baskets and later rehydrated and boiled (Gifford 1939:327; Greengo 1952:77-78; Kroeber and Barrett 1960:113). However, the lack of archaeological evidence does not allow us to go further. The analysis reveals the presence of traces of burning on some shells and barnacles representing on average less than 1 % of the NISP. These marks perhaps relate to secondary activities after consumption.

The distribution of the shell deposits seems spatially organized. Indeed, shell deposits were concentrated in the southern and southwestern ditches of the enclosure and in a specific pit (F 174). 60000 individual mussels were estimated for this pit alone. It is difficult to say whether these mussels were consumed in a single event or progressively over a long time. In the case of a single event, we can hypothesize an occasional big banquet during which many people ate mussels. In the case of the gradual deposition of mussels in the same pit, we then have to assume that marine waste management was efficient and highly structured.

#### **CONCLUSION**

The data revealed a large faunal spectrum, including shells and crabs. Despite the size and diversity of the sample, the mussel seems to be the only shell to have really played a role in the diet of the inhabitants of Cormelles. The cockle was probably not consumed and its presence is certainly incidental in the assemblage. The other marine invertebrates may have been brought to the site during the transport of mussels. Consumption of shellfish by the inhabitants of Cormelles-le-Royal was concentrated on a single species: the mussel. Indeed this site is characterized by the important presence of mussels of middle to large size. Gathered in a rocky or muddy-rock environment, they were then transported as far as 20 kilometers inland. The absence of small sized specimens of this species might indicate selectivity during collection on the seashore. This sorting could make the transport of the mussels more manageable but it could also be an indication of a trade in this shell. The transport was effected by boat along the Orne river or by land by means of a horse or chariot. The products of the sea collected were transported and eaten directly or preserved. The distribution of marine waste in the enclosure, restricted to certain places, could mark areas of preparation or consumption of mussels. The high density of mussel shells seems to demonstrate that this species was not a simple complement but a major food source, used at least for a domestic consumption. However, we can not exclude the hypothesis of major consumption events, like rituals or banquets, with the presence of 60 000 individuals in a single pit.

The organization of mussel exploitation during the Late Iron Age in the Plain of Caen reflects an interaction between several factors: cultural choices, social status, environmental data, human daily or seasonal activities (methods of acquisition, preparation and consumption) and circulation networks. All these factors can be investigated through the archaeomalacological study of Cormelles-le-Royal. However, many points still have to be clarified and explained on a local and regional scale. The residential sites excavated in the Plain of Caen, rich in shell deposits, have more information to give us. Nevertheless, so as to construct a fuller picture of the organization linked to the mussel exploitation, we also need to find sites located in coastal areas, which probably also took part in a potential trade of mussels and more widely of marine products (crustaceans, sea urchins, gastropods, sea salt).

## REFERENCES

- Audibert, C., and Deleamarre, J.-C. 2009. *Guide des coquillages de France, Atlantique et Manche*. Paris, Belin.
- Auxiette, G., Baudry, A. and Méniel P. 2010. Une histoire de l'élevage dans l'ouest de la Normandie: les sites de Mondeville, Iffs, Fleury, Creully (Calvados) et les Autres... In P. Barral, B. Dedet, F. Delrieu, P. Giraud, I. Le Goff, S. Marion, A. Villard-Le Tiec (dir.), *L'Âge du Fer en Basse-Normandie*, Actes du XXXIIIe colloque international de l'AFEAF; Caen 20 au 24 mai 2009, 185-202. Besançon, Presses universitaires de Franche-Comté.
- Bardot, A. 2010. *Les coquillages en Gaule romaine, entre Méditerranée et Rhin. Approche socio-économique et socio-culturelle*. Unpublished PhD thesis, University of Bordeaux 3, Bordeaux.
- Carpentier V. 2006. Un souterrain laténien dans son contexte à Cormelles-le-Royal (Calvados). *Mémoires de la Société des antiquaires de Normandie* 38, 209-218.
- Carpentier V. 2007. Images antiques, médiévales et modernes de la consommation des produits de la mer. Quelques données archéologiques récentes en Basse-Normandie. In E. Ridet, E. Barré and A. Zysberg (dir.), *Les nourritures de la mer, de la criée à l'assiette*, Actes du Colloque du Musée Maritime de l'île de Tatihou, 2 & 4 octobre 2003, 57-75. Caen, Centre de Recherche d'Histoire Quantitative.
- Carpentier, V. 2009. La consommation des produits de la mer. Quelques données archéologiques récentes en Basse-Normandie. *Archéopages* 26, 6-15.
- Carpentier, V., Marcigny, C., Savary, X. and Ghesquière E. 2002. Enclos et souterrain du Second Âge du Fer dans la Plaine de Caen, l'exemple de Cormelles-le-Royal (Calvados). *Revue Archéologique de l'Ouest* 19, 37-60.
- CLEMAM. 2011. Check List of European Marine Mollusca, <http://www.mnhn.fr/base/malaco.html>. (accessed august 15, 2011)
- Dupont, C. 2006a. Etude archéozoologique: la faune marine, coquillages et crustacés de la phase 3. In V. Carpentier, E. Ghesquière and C. Marcigny (dir.), *Grains de sel. Sel et salines du littoral bas-normand (Préhistoire – XIXe siècle)*, *Entre Archéologie et Histoire*, 111-116. Rennes, Centre Régional d'Archéologie d'Alet and A.M.A.R.A.I.
- Dupont, C.. 2006b. *La malacofaune de sites mésolithiques et néolithiques de la façade atlantique de la France: Contribution à l'économie et à l'identité culturelle des groupes concernés*. BAR International Series 1571. Oxford, Archaeopress.
- Gifford, E.W. 1939. The Coast Yuki. *Anthropos* 34, 292-375.
- Grayson, D. K. 1984. *Quantitative Zooarchaeology*. London, Academic Press.
- Greengo R.E. 1952. Shellfish foods of the California Indians. *Kroeber Anthropological Society Papers* 7, 63-114.
- Hayward, P. J. and Ryland J. S. 1995. *Handbook of the marine fauna of North-West Europe*, Oxford, University Press.

- Jahier I. 2009. Creully "Le Clos de l'Epinette" (Calvados). In P. Giraud, *Gaulois sous les pommiers, découvertes de l'âge du Fer en Basse-Normandie*. Cabourg, Cahiers du temps.
- Kroeber, A.L. and Barrett S.A. 1960. Fishing among the indians of Northwestern California. *Anthropological Records* 21 (1).
- Lepaumier, H. 2009. *Cormelles-le-Royal "Aire des Gens du Voyage", Un enclos du second âge du Fer en Plaine de Caen*. Document Final de Synthèse INRAP.
- Lepaumier, H., Vauterin, C.-C., Le Goff, E. and Villaregut, J. 2010. Un réseau de fermes en périphérie caennaise. In P. Barral, B. Dedet, F. Delrieu, P. Giraud, I. Le Goff, S. Marion, A. Villard-Le Tiec (dir.), *L'Âge du Fer en Basse-Normandie*, Actes du XXXIIIe colloque international de l'AFEAF; Caen 20 au 24 mai 2009, 139-158. Besançon, Presses universitaires de Franche-Comté.
- Lespez, L., Clet-Pellerin, M., Davidson, R., Hermier, G., Carpentier, V. and Cador J.-M. 2010. Middle to Late Holocene landscape changes and geoarchaeological implications in the marshes of the Dives estuary (NW France). *Quaternary International* 216, 23-40.
- Light, J. 2005. Marine mussel shells – wear is the evidence. In D. Bar-Yosef Mayer (ed.) *Proceedings of the 9th ICAZ Conference, Durham 2002 Archaeomalacology: Molluscs in former environments of human behaviour*, 56-62. Oxford, Oxbow books.
- Mc Carthy, A., Finlay, N. and Mc Clean O., 1999. Marine Molluscan Remains. In P. Woodman, C. Peter, L. Anderson and N. Finlay (eds), *Excavations at Ferriter's Cove, 1983-95: last foragers, first farmers in the Dingle Peninsula*, 93-102. Bray, Wordweel.
- Mougne, C., Dupont C., Lepaumier H., Quesnel L., 2013. Exploitation of marine Shells during the Late Iron Age: Gathering territory, dietary choices and circulation networks "The example of Cormelles-le-Royal (Plain of Caen, Lower-Normandy, France), In M.-Y Daire, C. Dupont, A. Baudry, C. Billard, J.-M. Large, L. Lespez, E. Normand, C. Scarre (eds), *Ancient maritime communities and the relationship between people and environment along the European Atlantic coasts*, International Conference HOMER 2011, Vannes, British Archaeological Reports (B.A.R.), 527-534.
- Mougne, C. (in progress). Exploitation des invertébrés marins (mollusques, crustacés et oursins) à la Protohistoire sur le territoire littoral et continental de la façade atlantique et de la Manche de la France. PhD thesis, University of Rennes 1, Rennes.
- Poppe, Guido T., and Goto Y. 1991. *European Seashells: Polyplacophora, Caudofoveata, Solenogastrea, Gasteropoda*. vol 1. Germany, Verlag Christa Hemmen.
- Poppe, Guido T., and Goto. Y. 1993. *European Seashells: Scaphopoda, Bivalvia, Cephalopoda*. vol 2. Germany, Verlag Christa Hemmen.
- Quéro, J.-C., and Vayne J.-J. 1998. *Les fruits de la mer et plantes marines des pêches françaises*. Lausanne, Delachaux et Niestlé.
- Vauterin, C.-C., Chanson, K., Zaour, N., Féret, L. and Le Forestier S. 2010. La culture matérielle de l'Âge du Fer: un outil de réflexion sur les sites d'habitat de Basse-Normandie. In P. Barral, B. Dedet, F. Delrieu, P. Giraud, I. Le Goff, S. Marion, A. Villard-Le Tiec (dir.), *L'Âge du Fer en Basse-Normandie*, Actes du XXXIIIe colloque international de l'AFEAF; Caen 20 au 24 mai 2009, 203-229. Besançon, Presses universitaires de Franche-Comté.

## FRESHWATER MOLLUSCS FROM AN EXCAVATED WELL AT YOTVATA, ARAVA VALLEY, ISRAEL

HENK K MIENIS<sup>5</sup>, Tel Aviv University

Several excavations have been carried out near Yotvata in the Arava Valley, Israel, by Dr. Ze'ev Meshel between 1975 and 1985, while Dr. Uzi Avner has more recently explored the Yotvata region. Meshel found material from the Early Arabic period, Avner found also remains from the Nabatean period.

The molluscs procured by Meshel were studied by Mienis (1994). They consisted of a mixture of local freshwater gastropods (10), a Late Cenomanian fossil (1), molluscs from the Red Sea (10) and a Mediterranean snail (1).

From the zoological point of view the presence of the local freshwater molluscs: *Melanoides tuberculata* (Müller, 1774) and *Melanopsis buccinoidea* (Olivier, 1801) were the most important ones because especially the latter forms a firm indication that once the springs near Yotvata carried water the whole year round. Today no freshwater molluscs are known to live in the Yotvata area.

Dr. Reuven Ortal sampled the area of the so-called "Mother-well" on 10 March 1993 in order to know more about the former mollusc fauna of the wells near Yotvata.

The "Mother-well" (coordinates 1538/2105) is situated at a height of + 80 m and has a radius of 20 m. It is encircled by a ring of soil which was taken out of the former well. This soil contained among others fragments of Nabatean pottery (Uzi Avner, personal communication to Reuven Ortal), an indication that the water of the well had been exploited at least from the Nabatean period (1<sup>st</sup> Century BCE) to the Early Arabic period (8<sup>th</sup> Century CE).

The "Mother-well" formed an integral part of an irrigation system characterized by tunnel wells (fugarot) which drew water from the aquifer to underground aquaducts.

The soil samples taken by Reuven Ortal from the well and the surrounding earthen ring contained the following seven aquatic snail species:

*Mercuria tchernovi* Mienis, 2011 – 3

*Heleobia* species – 49

*Melanoides tuberculata* (Müller, 1774) – 234

*Melanopsis buccinoidea* (Olivier, 1801) – 40

*Bulinus truncatus* (Audouin, 1826) – 4 fragmented shells

*Gyraulus piscinarum* (Bourguignat, 1852) – 4 fragmented shells

*Radix* species – 4 tiny juveniles

Our present knowledge of the inland *Heleobia* species occurring in the Syrian-African rift valley of which the Arava Valley is an integral part does not allow a further identification of these *Heleobia* specimens at the species level. The *Radix* specimens were too small to warrant any further identification.

However the material is enough to reach several conclusions. The prosobranchs among these snails: *Mercuria*, *Heleobia*, *Melanoides* and *Melanopsis*, are typical inhabitants of running water. The basommatophorans among them: *Bulinus*, *Gyraulus* and *Radix*, are at the other hand more indicators of standing or slow moving water. This indication was enforced by the finds of several characteristic barrel shaped *Chara*-fruits, a submerged aquatic plant. The pulmonate basommatophorans were all of a very small size and were present in the soil dropping out of the apertures of the much larger *Melanoides* and *Melanopsis* specimens. The presence of these two groups of gastropods show that most probably the strength of the water flow was not constant during the whole year.

---

<sup>5</sup> [mienis@netzer.org.il](mailto:mienis@netzer.org.il)

The presence of *Mercuria tchernovi*, *Bulinus truncatus*, *Gyraulus piscinarum* and *Radix* species in the sediments of the Yotvata "Mother-well" shows also that these species were once living much more to the south than today i.e. they form a strong indication of a shift in the rainfall pattern during historic times.

#### REFERENCES

Mienis, H.K., 1994. The molluscs of the excavation of the Early Arabic site of Yotvata, Arava Valley, Israel. Soosiana, 21-22: 22-28.

## THE SHELLS FROM THE EPIPALEOLITHIC SITE OF GIVAT HAYIL 35, WESTERN NEGEV, ISRAEL

HENK K MIENIS<sup>6</sup>, Tel Aviv University

#### ACKNOWLEDGEMENTS

I would like to thank Prof. Steven A. Rosen (Ben-Gurion University of the Negev) and Dr. Liora Kolska Horwitz (Hebrew University of Jerusalem) for giving me the opportunity to study the material from Givat Hayil 35.

#### INTRODUCTION

The site of Givat Hayil 35 (Israel Grid 11786/04363) was discovered by Prof. Steven A. Rosen during a survey carried out in the Western Negev, Israel, on behalf of the Israel Electric Corporation and the Israel Water Planning Commission (TAHAL). It turned out to be an Epipaleolithic site with remains from the Mushabian and Ramonian cultures. The Ramonian layer is overlaying the Mushabian one, but they are both dating back some 11.000 years BP. The site and the animal bones have been described in detail by Rosen & Horwitz (2005).

#### THE SHELLS

The shells found at Givat Hayil 35 have not been dealt with so far. They were found in five areas, of which three were on the surface and two were respectively an upper and a lower subsurface one. Two areas are characterized by flints from the Ramonian culture, while three are representing the Mushabian culture (**TABLE 1**).

SITE	CULTURAL TYPE	SITE	CULTURAL TYPE
Area A - surface	Ramonian	Area C- upper	Mushabian
Area B - surface	Mushabian	Area C- lower	Mushabian
Area C - surface	Ramonian		

TABLE 1: THE FIVE AREAS AT GIVAT HAYIL 35 CARRYING SHELLS AND THEIR CULTURAL AFFINITIES.

The excavation produced 183 shells: 127 associated with the Ramonian culture and 56 representing the Mushabian culture. They turned out to belong to 10 different species (**TABLE 2**).

	Area A	Area B	Area C Surface	Area C Upper	Area C Lower	TOTAL
<i>Columbella rustica</i>	8	-	1	1	-	10
<i>Xerocrassa langloisiana</i>	2	-	-	-	-	2
<i>Xerocrassa seetzenii erkelii</i>	8	-	14	5	29	56
<i>Xerocrassa</i> species	-	-	-	-	7	7
<i>Sphincterochila zonata</i>	50	7	27	1	1	86
<i>Eremina desertorum</i>	6	1	-	-	1	8
<i>Helix engaddensis</i>	2	-	-	-	-	2
<i>Antalis inaequicostatum</i>	1	1	1	1	-	4
<i>Antalis rosatti</i>	1	-	2	-	-	3
<i>Antalis vulgare</i>	3	-	1	1	-	5
<b>TOTAL</b>	<b>81</b>	<b>9</b>	<b>46</b>	<b>9</b>	<b>38</b>	<b>183</b>

TABLE 2: SHELLS FOUND IN THE FIVE AREAS SAMPLED AT GIVAT HAYIL 35.

<sup>6</sup> [mienis@netzer.org.il](mailto:mienis@netzer.org.il)



## DISCUSSION

The shells found at Givat Hayil 35 originated from two different areas: the immediate surroundings of the site and the Mediterranean Sea. Most of the shells (161) are representing six local species of land snails of which at least five are still living in the area today.

More than 70% of the land snails were found on the surface and are therefore most probably of much more recent origin. This is especially true for the thick-shelled *Sphincterochila zonata* of which 84 out of a total of 86 were found on the surface.

Even the shells of land snails which were encountered subsurface might have a much younger age since some of them are aestivating while deeply buried in the ground and not always survive such periods of long inactivity.

The *Xerocrassa* species of which seven shells were found in the lower layer of Area C, is most probably a species which is not living today in the Western Negev or elsewhere in the Levant. It resembles most closely very small specimens of *Xerocrassa langloisiana*, however the few specimens of this unknown *Xerocrassa* species does not allow a more specific identification.

The shells from the Mediterranean Sea were most probably all exploited as shell beads. All the Dove shells *Columbella rustica* show a man made hole just behind the enforced lip of the aperture and has been transformed in that way in shell beads. The Tusk shells (*Antalis* species) may be considered natural shell beads because they are open at both ends and have been exploited intensively as beads in the Levant (Bar-Yosef, 2008 & 2010).

## CONCLUSION

The shells found at the Epipaleolithic site of Givat Hayil 35 consisted of two groups: local land snails (161 out of a total of 183) and marine shells from the Mediterranean Sea (the remaining 22 shells). Only the marine shells were exploited by the inhabitants of the site as shell beads.

The land snails are most likely all natural remains of snails which were living at Givat Hayil from the Epipaleolithic period and onwards.

Interesting from a zoological point of view forms the finding of seven shells of an extremely small *Xerocrassa* species never recorded before from the Levant. More specimens are however necessary in order to establish its proper identity.

## REFERENCES

- Bar-Yosef Mayer, D.E., 2008. *Dentalium* shells used by hunter-gatherers and pastoralists in the Levant. *Archaeofauna*, 17: 103-110.
- Bar-Yosef Mayer, D.E., 2010. The lessons of *Dentalium* shells in the Levant. *Journal of the Israel Prehistoric Society*, 40: 219-228.
- Rosen, S.A. & Horwitz, L.K., 2005. Givat Hayil 35: a stratified Epipaleolithic site in the Western Negev. *Journal of the Israel Prehistoric Society*, 35: 201-228.
-

## SHELLS FROM AN EXCAVATION NEAR BIR EL TAMAD, SINAI, EGYPT

HENK K MIENIS<sup>7</sup>, Tel Aviv University

### ACKNOWLEDGEMENTS

I would like to thank Dr. Benett Kozloff and Prof. O. Bar-Yosef for entrusting me with the archaeomalacological material from Bir el Tamad.

### INTRODUCTION

In the early seventies of the 20<sup>th</sup> Century Dr. Benett Kozloff carried out some excavations in Sinai, Egypt (Kozloff, 1973-1974). One of the excavated sites was Bir el Tamad (= site 699: Themed), a habitation site about 64 km west of Elat, Israel. Among the archaeozoological finds were also four small samples of molluscs, which were forwarded to me for identification by Prof. Ofer Bar-Yosef in 1984. A fifth sample is not dealt with here because it is much more likely a part of a vertebrate tooth.

### RESULTS

The archaeomalacological material could be identified as follows:

#### Gastropoda

Family Columbellidae

*Mitrella albina* (Kiener, 1841)

699P/1: one shell with a man made hole behind the palatal lip of the aperture.

Family Costellariidae

*Vexillum cadaverosum* (Reeve, 1844)

699K/4: one shell missing the large body whorl.

Family Olividae

*Ancilla lineolata* (A. Adams, 1853)

699K-017: one complete shell.

Family Conidae

*Conus virgo* Linnaeus, 1758

699P/1: one fragment of the top.

#### Scaphopoda

Family Dentaliidae

*Antalis vulgaris* (Da Costa, 1778)

0699K/2: one small piece of 11.5 mm length.

### DISCUSSION

#### *Origin of the shells*

All the samples consisted of marine molluscs. The four gastropod species among them are well-known inhabitants of the Red Sea in general and the Gulf of Aqaba in particular. The latter is situated at a distance of only 64 km from the site. Interestingly the sole Tusk shell (Scaphopod) originated from the Mediterranean Sea at a minimum distance of at least some 176 km!

#### *Exploitation*

At least one shell: *Mitrella albina*, had been transformed into a shell bead by making a hole behind the palatal lip of the aperture. Maybe they tried to do the same with the shell of *Vexillum cadaverosum*, which is of the same form, size and colour as *Mitrella albina*. Unfortunately the part which should show the man made hole is missing from the shell. Most probably they tried to transform the top of the Cone shell: *Conus virgo*, into a shell disk but before they could smooth out the bottom part and made a hole in the top it was broken and abandoned.

The single Tusk shell was most likely exploited as a natural shell bead since it is open at both sides.

---

<sup>7</sup> [mienis@netzer.org.il](mailto:mienis@netzer.org.il)

### *Age of the material*

According to the results of the dating processes carried out on charcoal found at the site, the shell material recovered at Bir el Tamad was accumulated approximately 2990-2850 years ago (Rothenber & Glas, 1992; Avner, 2003). This means that the shell material was most probably of Iron Age II origin.

### REFERENCES

Avner, U., 2003. *Studies in the Material and Spiritual Culture of the Negev and Sinai Population during the 6th-3rd Millennia B.C.*. Unpublished Ph-D.-thesis Hebrew University of Jerusalem. 388 pp.

Kozloff, B. 1973-1974. A brief note on the lithic industries of Sinai. *Museum Ha'aretz Yearbook*, 15-16: 35-49.

Rothenberg, B. and Glass, J., 1992. The beginnings and the development of early metalurgy and the settlement and chronology of the Western Arabah, from the Chalcolithic Period to Early Bronze Age IV. *Levant*, 24: 141-157.

---

### RECENT PUBLICATIONS

**MASHKOUR, M., TENGBERG, M., SHIRAZI, Z. and MADJIDZADEH, Y., 2013.** Bio-archaeological studies at Konar Sandal, Halil Rud basin, southeastern Iran. *Environmental Archaeology*, 18 (3): 222-246.

### ABSTRACT

Archaeobiological material recovered from the excavation of two mounds, Konar Sandal South (KSS) and Konar Sandal North (KSN) in the Halil Rud valley in south-eastern Iran is presented and analysed. The Bronze Age site of KSS was occupied during the 3rd millennium BC. Samples from KSN were Iron Age and late 2nd to mid 1st millennium BC in date. The sites are approx. 250 km from the Persian Gulf. Together they yielded 25 species of marine molluscs, which occurred in very low numbers. Twenty-four species and 40 individuals were recorded at KSS and only six species and seven individuals at KSN. Their possible utilisation as ornaments is not considered, although virtually all of the species would appear to fall into the ornamental category: *Architectonica perspectiva*, *Conus* spp., *Cypraea* sp., *Dentalium octangulatum*, *Engina mendicaria*, etc. The range of species shows greater affinity with shells found at Omani sites rather than sites further to the east and this has important implications for understanding trade routes and cultural interactions. The most frequent mollusc, and the only non-marine species present, was the freshwater *Melanoides tuberculata* with 15 and 11 specimens recorded from KSS and KSN, respectively. (JRS)

\*\*\*\*\*

**DUPONT C.<sup>8</sup>, 2013** - Teinture et exploitation du pourpre *Nucella lapillus* le long du littoral atlantique français. In *Daire M.Y., Dupont C., Baudry A., Billard C., Large J.M., Lespez L., Normand E., Scarre C. (eds.), Actes du colloque HOMER2011. "Ancient maritime communities and the relationship between people and environment along the European Atlantic coasts/ Anciens peuplements littoraux et relations homme/milieu sur les côtes de l'Europe atlantique"* British Archaeological Reports, Archeopress, Oxford, BAR S2570, ISBN 9781407311913, 459-467.

### ABSTRACT

The extraction of dyes from marine shells is known on several continents. Although less visible by the quantity of wastes and the durability of this activity, the extraction of dyes from shells is also attested along the Channel and the European Atlantic coast. In this paper, we propose to present a synthesis from the archaeological clues of this activity on the French territory and its coast, which extends from the English Channel and the Atlantic facade. The criteria which make it possible to detect this activity of dyeing from the shelly remains discovered during surveys and archaeological excavations will first be described. The detected sites will be presented as well as a

---

<sup>8</sup> catherine.dupont@univ-rennes1.fr

critical study of the quality of the results obtained according to the sampling (surveys, diagnostics, excavations) and the chronological extension of dyeing activities. For the best documented sites, malacological analyses were applied to know some more on the various stages of exploitation of the natural stock of shells accessible near the archeological sites. We thus can see that diversity hides behind an apparent homogeneity of these accumulations of shells.

\*\*\*\*\*

**SAAFI I., AOUADI N., DUPONT C., BELHOUCHE L., 2013** - L'économie de subsistance dans la cuvette de Meknassy (Sidi Bouzid, Tunisie centrale) durant l'Holocène d'après l'étude malacologique. *Bulletin de la Société Préhistorique Française*. Tome 110-4, 703-718.

Contact: [catherine.dupont@univ-rennes1.fr](mailto:catherine.dupont@univ-rennes1.fr)

#### ABSTRACT

Malacological studies using land snail shells found at archeological sites are very scarce in the Maghreb while those remains are the main constituent of Holocene sites called locally Rammadiyet. In this paper, studied open-air prehistoric sites belong to Capsian culture. In eastern Maghreb Capsian culture is one of Epipaleolithic cultures and is inherent to Tunisia and oriental part of Algeria. Capsian open-air sites are huge oval accumulations of ashes, a lot of land-snail shells and burned stones, flint material and faunal remains. Two subdivisions are known from Capsian Culture: Typical Capsian and Upper Capsian. The prehistoric sites examined at this work are from Upper Capsian subdivisions. Different facies or "regional varieties" are known from Capsian sites. Chronologically, Capsian sites with their different facies, dated by Carbon 14 gave an age included between 10 000 and 6000 years B.P. The Capsian groups are considered as the last hunters-gatherers in the Maghreb. The mode of subsistence of those humans groups is gathering land snails, hunting wild animals and picking fruits.

Standard malacological studies elaborate from rammadiyet remains however insufficient to detect the impact of the land snails on the subsistence economy of Capsian communities. Our study includes simultaneously the identification of the land snail shells (species), try of determination of their ages and taphonomic analyses. This study permit to propose for both studied sites, a reconstruction of the contribution of land snails Capsian population food, and to try the identification of the season of the collect of mollusks. Our work concerned two series resulting from surveys practiced in 2005 in tow stratified rammadiyet : El Oghrab and Aïn Oum Henda 1 (Meknassy, central Tunisia). Careful investigations on the stratigraphy, as well as on the material culture (lithic industry) and faunal remains from both sites are elaborated. Faunal remains are scarce at Rammadiya El Oghrab and missing at Rammadiya Aïn Oum Henda 1. For malacofauna, we adopted an exploitable method of work for the study of collections resulting from other similar sites. After the identification of the species we quantified them by the NISP (number of identified remains for each species), then we calculate the minimum number of individuals (MNI). We take some measurement (height and diameter) for each shell. We classified fragments of shells in different classes. A specific fragment typology is adopted (from Type 0 until Type 6).

In this paper we present the results of analysis of series of malacofauna coming from both rammadiyet. We have highlighted the presence of nine species of land snails: *Helix melanostoma*, *Helix* sp., *Eobania vermiculata*, *Otala lactea*, *Helicella ambilina*, *Helicella variabilis*, *Helicella* sp., *Leucochroa candidissima*, *Rumina decollata*. Two land snails species prevail which are *Leucochroa candidissima* and *Helix melanostoma*. It would be confirm a selection done by human group among the available species in their surrounding environment. This choice is also affected by the abundance of these two species in the environment of sites according to the seasons and the paleoenvironmental conditions. This selection is also manifested by the size of collected land snails. The Capsian populations collect most of gastropods in adult age and privileged the biggest individuals which are most provided by meat.

According to the taphonomic study and especially to the typology of fragments we have a high percentage of broken shells that are undoubtedly related to the trampling and not to the method of human consumption of these mollusks. The trampling can be related to the nature of the activities which took place on the site or in the topographic position of both rammadiyet (in height, near a small stream) in the basin of Meknassy. It was a stopping place of prehistoric humans coming from the region of Gafsa and western (high plateaus of Tebessa) and going either northward or towards the Mediterranean coast. Further to those successive passages we have an important quantity of broken shells. The presence of a marine shell (*Columbella rustica*) shows another aspect of behaviour of Capsian groups. We deduct an exchange between the Capsian populations and coastal communities. The gathering and consumption of land snails at these sites seem to be seasonally.

We note changing in the amount of each species (NISP) and composition of species spectrum from different levels of the rammadiya of El Oghrab. The gathering of land snails was mainly made during spring and autumn. This essay of seasonality helps us to reconstitute the life mode of Capsian communities. These human groups, last hunters-gatherers in Tunisia and in Algeria, survived mainly on the gathering of land snails and occasionally on the cynegetic activity. These results help to reconstitute environments and Capsian culture but still require additional examination of material from others rammadiyet in Tunisia.

The malacological species consumed by prehistoric human occupied an environment wetter than the current. Nowadays these species of snails (*Leucochroa candidissima*, *Helicella* sp. , *Helix melanostoma*) are extremely rare even missing and that indicate an increase of the aridity in central Tunisia. When Capsian communities disappeared and the Neolithic of Capsian tradition group appeared there was no changing in the consumption of land-snails. Populations of the Neolithic of Capsian tradition continued to gather and consume terrestrial snails as well as some domestic fauna.

\*\*\*\*\*

**MIENIS, H.K., 2013.** The shells, pp.54-55. In: Golani, A., Rescue excavations at the Early Bronze Age site of Qiryat Ata – Area O. *Atiqot*, 75: 27-60.

#### ABSTRACT

Further excavations in advance of housing development at Qiryat Ata on the coastal plain of Galilee, Israel, have provided additional information concerning this Early Bronze Age fortified town. Eight species of Mollusca were recovered but in very low numbers, with only 11 specimens overall. These comprised Mediterranean marine gastropods (*Tonna galea*, *Bolinus brandaris*, *Stramonita haemastoma*) and bivalves (*Glycymeris glycymeris pilosa*, *Glycymeris insubrica*, *Cerastoderma glaucum*), a local freshwater mussel (*Unio mancus eucirrus*) and a land snail (*Helix engaddensis*). Most shells were worn and/or fragmentary and only the single valve of *Glycymeris insubrica* showed evidence of manipulation, with a manmade hole in the umbo. (JRS)

\*\*\*\*\*

**VAN DEN BRINK, E.C.M., RUTGAIZER, O., GORIN-ROSEN, Y., HORWITZ, L.K., LIPHSCHITZ, N. AND MIENIS, H.K., 2013.** Two Roman-Byzantine subsurface features at Ḥorbat Qaṣṭra (Castra), at the foot of Mount Carmel. *Atiqot*, 75: 71-127.

#### ABSTRACT

Two subterranean features associated with above-ground domestic structures were excavated at the Roman-Byzantine site of Ḥorbat Qaṣṭra at the western foot of Mount Carmel, Israel. Feature 1070 comprised two adjoining chambers, both of which were filled with redeposited material that yielded just three shells: one *Patella caerulea*, one *Phalium granulatum undulatum* with the lip missing, and one holed *Bolinus brandaris*. Feature 1071 consisted of two chambers of a karstic cave that had been altered by human activity and contained a large assemblage of glass and pottery dating to the late Byzantine-Umayyad periods. It also contained 397 shells and shell fragments, including 234 live-collected *Patella caerulea*. Other Mediterranean marine species may also have been exploited for food (*Osilinus turbinatus*, *Mytilus galloprovincialis*, *Cerastoderma glaucum*), or as ornaments

(*Neverita josephinia*, *Hexaplex trunculus*, 'cassid' lips, *Glycymeris* spp., *Acanthocardia tuberculata*), or as building material (*Stramonita haemastoma* and *Glycymeris insubrica* shells filled with plaster); one small *Charonia tritonis variegata* may have served as a trumpet. The Nilotic freshwater mussel *Chambardia rubens arcuata* indicated trade connections with Egypt. Three terrestrial species (*Pomatias olivieri*, *Calaxis hierosolymarum*, *Helix engaddensis*) may be intrusive. (JRS)

\*\*\*\*\*

**DAIRE M.Y., DUPONT C., BAUDRY A., BILLARD C., LARGE J.M., LESPEZ L., NORMAND E., SCARRE C. (EDS.), 2013** - *Actes du colloque HOMER2011. " Anciens peuplements littoraux et relations homme/milieu sur les côtes de l'Europe atlantique / Ancient maritime communities and the relationship between people and environment along the European Atlantic coasts "* *British Archaeological Reports*, Archeopress, Oxford, BAR S2570, ISBN 9781407311913, 672 pages.

*An international scientific meeting...*

The HOMER 2011 conference was the first international scientific meeting devoted to the archaeology of coastal populations and the interactions between people and the environment in the geographical domain of the English Channel and Atlantic Europe. Recent advances in the archaeology of coasts and islands in the interlinked Atlantic, English Channel and North Sea complex were explored during the seven sessions of the conference, both through syntheses and through presentations focusing on individual research projects, some of them completed, others still ongoing.

The varied and extensive conference program, with 92 papers and posters, and delegates from 14 nations, led us on a voyage along the shores of every country of Western Europe, and on a journey through time from early prehistory to the 20th century. Such diversity was reflected in the wealth and quality of the scientific exchanges, and underpinned the success of the HOMER 2011 conference, which we hope will be a first step in strengthening European networks for research in coastal archaeology in all its forms.

Section 1. The potential of coastal archaeological sites (underwater, intertidal, shoreline) and specific methods linked to their field study.

Section 2. New challenges for sustainable coastal archaeology in the 21st century

Section 3. European maritime fish weirs and fish traps.

Section 4. Peoples of the shore, peoples of the sea: Identity, space and territory.

Section 5. Seafaring, maritime traffic and port installations.

Section 6. Exploitation of coastal and marine resources: acquisition, distribution, consumption and transformation.

Session 7. Geoarchaeology and environmental studies of maritime and coastal landscapes

\*\*\*\*\*

**DUPONT C., 2012**– « Ne confondons pas coquilles et coquillages. Vision diachronique de l'archéologie des mollusques le long de la façade atlantique française. ». *Techniques & Culture. Itinéraires de coquillages*, [0248-6016/978-2-7351-1534-1], 59, 2012/2, 242-259. *Contact: catherine.dupont@univ-rennes1.fr*

## ABSTRACT

The archaeomalacology is still a new discipline of the archaeology. It brings to light uses of shells sometimes forgotten along the French Atlantic coast.

Several activities require the gathering of the alive animal like the food consumption or the extraction of dye, the others use only the test (ornament, elements of construction, wall decoration, tool). Throughout the chronology, the same phenomenon repeats. The shells of the consummate shellfish are rarely recycled. The archaeology allows to bring to light this dichotomy from their acquisition. So, the gathering of the fresh shell seems to correspond to a different activity from the one which consists in collecting shells devoid of some flesh.



If certain marine mollusks formerly consummate are not eaten any more at present, it is not only linked to a loss of their accessibility. Social or environmental phenomena were able to erase species of marine mollusks as food resource of our memory. The constraint connected to the preservation of the animal, mostly freshly, limited in the past, the distribution of this food resource on long distance. This limiting factor is not the only one to have exercised a sorting among the species consumed far from the coast. Indeed, the archaeology allows to compare the marine resources consumed by the populations vassal of the coastal zones of those occupying more continental territories. It is not necessarily the mollusks which resist best stays outside the sea water, which will be the most appreciated by the populations the most distant from the natural deposits.

Finally, shells discovered in archaeological contexts are sometimes involuntarily transported by the man by means of vectors. These last ones are witnesses of other anthropological activities confidentially connected to the marine environment.

---

## **PHD ABSTRACT: MARINE INVERTEBRATES AND MONASTIC ESTABLISHMENTS ALONG THE FRENCH ATLANTIC COAST DURING THE MIDDLE AGES**

**LAURA LE GOFF<sup>9</sup>, CATHERINE DUPONT<sup>10</sup>**

Although the archaeozoological studies on medieval archaeological sites become more frequent in France, malacofauna is too rarely taken into account. Besides, medieval and modern written sources are very discreet about shells: culinary books include very few recipes with marine invertebrates. Yet the inventory of dumps and their components certifies that medieval populations have eaten and used these marine resources, sometimes on a large scale. We chose to study monastic communities along the French Atlantic coast – such as the abbeys of Landévennec (Finistère) and Fontdouce (Charente-Maritime) – for two main reasons. Firstly, monks had to follow a very strict diet, including many fasting days where meat could be replaced by aquatic products. These littoral communities were surely significant consumers of marine mollusks. Secondly, we can hope that these monks kept records – which may have been preserved until today – of their purchases, sales and earnings from the tithe. Therefore, it could be very interesting to confront written and archaeological sources. These researches will be approached with the classic archaeomalacological methods – species determination, quantification, and biometrics – and also with some new methodological developments such as sclerochronology and infesting/encrusting organisms' identification. This work is currently the subject of a PhD thesis at Rennes II University and at the Research Center of Archaeology, Archaeological sciences and History (CReAAH).

---

## **FORTHCOMING CONFERENCES**

### **MOLLUSCS IN ARCHAEOLOGY MEETING, NATURAL HISTORY MUSEUM**

**NATURAL HISTORY MUSEUM, LONDON**

**26<sup>TH</sup> APRIL 2014**

The subject of 'Molluscs in Archaeology' has not been dealt with collectively for probably 3-4 decades. This meeting addresses that and embraces a wide range of aspects of molluscs in archaeology. The meeting is held in Natural History Museum, London where lectures will be in the Neil Chalmers Lecture Theatre and exhibits, displays and stereo-binocular microscopes will be available in the Angela Marmont Centre. The aim is not to present information from individual sites per se (just because it's a good data set), but to use information from archaeological contexts to show case a particular theme, interpretation, idea or concept.

The deadline for registration has been extended to **18<sup>th</sup> April 2013**.

<http://envarch.net/events/13/aea-spring-conference-with-the-conchological-society-of-great-britain-and-ireland->

---

<sup>9</sup> PhD Student, UMR 6566, CReAAH, University of Rennes 2, France; laura.legoff@univ-rennes2.fr

<sup>10</sup> CNRS researcher, UMR 6566, CReAAH, University of Rennes 1, France; catherine.dupont@univ-rennes1.fr

## **MOLLUSCA 2014 – THE FIRST ALL-AMERICA MALACOLOGICAL CONFERENCE**

**UNIVERSIDAD NACIONAL AUTONOMA DE MEXICO, MEXICO CITY**

**23<sup>RD</sup> – 28<sup>TH</sup> JUNE 2014**

Mollusca 2013 will bring you outstanding conferences, posters, access to collections and field trips and will be organized in Mexico City, an exciting metropolis. The organisers will be announcing a call for sessions, symposia and activities in January 2014.

**CONTACT:** Edna Naranjo-Garcia or Paul Valentich-Scott at: [Mollusca2014@gmail.com](mailto:Mollusca2014@gmail.com)  
[http://sbnature.org/content/805/file/Mollusca2014\\_FirstCircular\\_hres\\_en.pdf](http://sbnature.org/content/805/file/Mollusca2014_FirstCircular_hres_en.pdf)

## **INTERNATIONAL COUNCIL OF ARCHAEOZOOLOGY (ICAZ) 12<sup>TH</sup> ANNUAL CONFERENCE**

**SAN RAFAEL, MENDOZA, ARGENTINA**

**22<sup>ND</sup> – 27<sup>TH</sup> SEPTEMBER 2014**

Three archaeomalacological sessions will run at the forthcoming ICAZ conference.

EXPLOITATION OF ANIMAL BASED RAW MATERIALS: TECHNOLOGICAL AND SOCIO-CULTURAL ISSUES:

*Organisers: Natacha Buc, Annalisa Christie, Alice Choyke, Vivian Scheinsohn*

Animals are exploited by humans in a variety of ways. Archaeozoological studies often stress food consumption and production although animals were also important sources of raw materials (leather, bone, antler, tooth, shell, etc). The session is divided into two parts exploring technological issues in part one, and sociocultural issues in part two. Both parts look for universal patterning in the way animals are used as sources for raw materials, stressing comparative aspects. Papers focus on choice of taxa, biomechanics, subsistence, ethno-archaeology, ethnography, availability, and raw material selection, technical style and social identities, as well as symbolic and ritual aspects.

[www.icaaz2014argentina.com/inicio/index.php?option=com\\_content&view=article&id=17&catid=3&Itemid=7&lang=en](http://www.icaaz2014argentina.com/inicio/index.php?option=com_content&view=article&id=17&catid=3&Itemid=7&lang=en)

MOLLUSCS AS A RECORD OF HUMAN-ENVIRONMENT RELATIONSHIPS: ENVIRONMENTAL RECONSTRUCTIONS, IMPACTS, AND MANAGEMENT

*Organizers: Christina M. Giovas, Zhanna Antipushina and Catherine F. West*

This session will examine the ways in which mollusc remains serve as environmental proxies, as well as reflect the complex relationship between humans, aquatic resources, and the environment. The goal of this session is to bring together international scholars to provide a synthetic treatment of these issues, integrating and extending the methodology and theory employed by researchers to address topics at the intersection of human paleoecology, archaeomalacology, and the environment.

[www.icaaz2014argentina.com/inicio/index.php?option=com\\_content&view=article&id=21&catid=3&Itemid=7&lang=en](http://www.icaaz2014argentina.com/inicio/index.php?option=com_content&view=article&id=21&catid=3&Itemid=7&lang=en)

MALACOLOGICAL AND ISOTOPIC STUDIES ALONG THE PACIFIC COAST

*Organisers: Carola Flores and Marcelo Rivadeneira*

The presents and discusses studies from different places along the Pacific Coast related to malacological and isotopic analyses on mollusk shells and their applications on research questions about marine resource exploitation and human adaptation. The symposium will emphasize the interaction between archaeologists working on coastal settings and with malacological remains and scientists from related disciplines such as ecology, paleoecology, oceanography and paleoceanography. Also, we want to provide an opportunity of discussion about different methodological approaches related to the natural and cultural differences of research settings along the Pacific Coast.

[www.icaaz2014argentina.com/inicio/index.php?option=com\\_content&view=article&id=49&catid=2&Itemid=20&lang=en](http://www.icaaz2014argentina.com/inicio/index.php?option=com_content&view=article&id=49&catid=2&Itemid=20&lang=en)